INTERNATIONAL

MARINE ENGINEERING

Published Monthly by ALDRICH PUBLISHING CO.

461 EIGHTH AVENUE, NEW YORK — 8 BOUVERIE ST., LONDON, E. C.

H. L. Aldrich, President and Treasurer — Assoc. Member of Council, Soc. N. A. and M. E.
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Edited by H. H. Brown, A. M. Inst. N. A.
Member Soc. N. A. and M. E.

Vol. XXII — MAY, 1917 — No. 5

Proclamation By the President to the People

The White House, April 15, 1917.

My Fellow-Countrymen:

THE ENTRANCE of our own beloved country into the grim and terrible war for democracy and human rights which has shaken the world creates so many problems of national life and action which call for immediate consideration and settlement that I hope you will permit me to address to you a few words of earnest counsel and appeal with regard to them.

We are rapidly putting our navy upon an effective war footing and are about to create and equip a great army, but these are the simplest parts of the great task to which we have addressed ourselves. There is not a single selfish element, so far as I can see, in the cause we are fighting for. We are fighting for what we believe and wish to be the rights of mankind and for the future peace and security of the world. To do this great thing worthily and successfully we must devote ourselves to the service without regard to profit or material advantage and with an energy and intelligence that will rise to the level of the enterprise itself. We must realize to the full how great the task is and how many things, how many kinds and elements of capacity and service and self-sacrifice it involves.

These, then, are the things we must do, and do well, besides fighting—the things without which mere fighting would be fruitless:

We must supply abundant food for ourselves and for our armies and our seamen, not only, but also for a large part of the nations with whom we have now made common cause, in whose support and by whose sides we shall be fighting.

We must supply ships by the hundreds out of our shipyards to carry to the other side of the sea, submarines or no submarines, what will every day be needed there, and abundant materials out of our fields and our mines and our factories with which not only to clothe and equip our own forces on land and sea, but also to clothe and support our people, for whom the gallant fellows under arms can no longer work; to help clothe and equip the armies with which we are co-operating in Europe, and to keep the looms and manufactories there in raw material; coal to keep the fires going in ships at sea and in the furnaces of hundreds of factories across the sea; steel out of which to make arms and ammunition both here and there; rails for worn-out railways back of the fighting fronts; locomotives and rolling stock to take the place of those every day going to pieces; mules, horses, cattle for labor and for military service; everything with which the people of England and France and Italy and Russia have usually supplied themselves, but cannot now afford the men, the materials, or the machinery to make.

It is evident to every thinking man that our industries, on the farms, in the shipyards, in the mines, in the factories, must be made more prolific and more efficient than ever, and that they must be more economically managed and better adapted to the particular requirements of our task than they have been; and what I want to say is that the men and the women who devote their thought and their energy to these things will be serving the country and conducting the fight for peace and freedom just as truly and just as effectively as the men on the battlefield or in the trenches. The industrial forces of the country, men and women alike, will be a great national, a great international service army—a notable and honored host engaged in the service of the nation and the world, the efficient friends and saviors of free men everywhere. Thousands, nay, hundreds of thousands, of men otherwise liable to military service will of

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right and necessity be excused from that service and assigned to the fundamental sustaining work of the fields and factories and mines, and they will be as much a part of the great patriotic forces of the nation as the men under fire.

I take the liberty, therefore, of addressing this word to the farmers of the country and to all who work on the farms: The supreme need of our own nation and of the nations with which we are co-operating is an abundance of supplies, and especially of foodstuffs. The importance of an adequate food supply, especially for the present year, is superlative. Without abundant food alike for the armies and the peoples now at war, the whole great enterprise upon which we have embarked will break down and fail. The world's food reserves are low. Not only during the present emergency, but for some time after peace shall have come, both our own people and a large proportion of the people of Europe must rely upon the harvests in America.

Upon the farmers of this country, therefore, in large measure rests the fate of the war and the fate of the nations. May the nation not count upon them to omit no step that will increase the production of their land or that will bring about the most effectual co-operation in the sale and distribution of their products? The time is short. It is of the most imperative importance that everything possible be done, and done immediately, to make sure of large harvests. I call upon young men and old alike and upon the able-bodied boys of the land to accept and act upon this duty—to turn in hosts to the farms and make certain that no pains and no labor is lacking in this great matter.

I particularly appeal to the farmers of the South to plant abundant foodstuffs, as well as cotton. They can show their patriotism in no better or more convincing way than by resisting the great temptation of the present price of cotton and helping, helping upon a great scale, to feed the nation and the peoples everywhere who are fighting for their liberties and for our own. The variety of their crops will be the visible measure of their comprehension of their national duty.

The government of the United States and the governments of the several States stand ready to co-operate. They will do everything possible to assist farmers in securing an adequate supply of seed, an adequate force of laborers when they are most needed, at harvest time, and the means of expediting shipments of fertilizers and farm machinery, as well as of the crops themselves when harvested. The course of trade shall be as unhampered as it is possible to make it, and there shall be no unwarranted manipulation of the nation's food supply by those who handle it on its way to the consumer. This is our opportunity to demonstrate the efficiency of a great democracy, and we shall not fall short of it!

This let me say to the middlemen of every sort, whether they are handling our foodstuffs or our raw materials of manufacture or the products of our mills and factories: The eyes of the country will be especially upon you. This is your opportunity for signal service, efficient and disinterested. The country expects you, as it expects all others, to forego unusual profits, to organize and expedite shipments of supplies of every kind, but especially of food, with an eye to the service you are rendering and in the spirit of those who enlist in the ranks, for their people, not for themselves. I shall confidently expect you to deserve and win the confidence of people of every sort and station.

To the men who run the railways of the country, whether they be managers or operative employees, let me say that the railways are the arteries of the nation's life and that upon them rests the immense responsibility of seeing to it that those arteries suffer no obstruction of any kind, no inefficiency or slackened power. **To the merchant let me suggest the motto, "Small profits and quick service," and to the shipbuilder the thought that the life of the war depends upon him. The food and the war supplies must be carried across the seas, no matter how many ships are sent to the bottom. The places of those that go down must be supplied, and supplied at once.** To the miner let me say that he stands where the farmer does: the work of the world waits on him. If he slackens or fails, armies and statesmen are helpless. He also is enlisted in the great Service Army. The manufacturer does not need to be told, I hope, that the nation looks to him to speed and perfect every process; and I want only to remind his employees that their service is absolutely indispensable and is counted on by every man who loves the country and its liberties.

Let me suggest, also, that every one who creates or cultivates a garden, helps, and helps greatly, to solve the problem of the feeding of the nations; and that every housewife who practices strict economy puts herself in the ranks of those who serve the nation. This is the time for America to correct her unpardonable fault of wastefulness and extravagance. Let every man and every woman assume the duty of careful, provident use and expenditure as a public duty, as a dictate of patriotism, which no one can now expect ever to be excused or forgiven for ignoring.

In the hope that this statement of the needs of the nation and of the world in this hour of supreme crisis may stimulate those to whom it comes and remind all who need reminder of the solemn duties of a time such as the world has never seen before, I beg that all editors and publishers everywhere will give as prominent publication and as wide circulation as possible to this appeal. I venture to suggest, also, to all advertising agencies that they would perhaps render a very substantial and timely service to the country if they would give it widespread repetition. And I hope that clergymen will not think the theme of it an unworthy or inappropriate subject of comment and homily from their pulpits.

The supreme test of the nation has come. We must all speak, act, and serve together!

WOODROW WILSON.

The Editorial Conference of the New York Business Publishers Association, Inc., at a luncheon on April 16, passed the following resolution:

"Resolved, The members of the Editorial Conference of the class journals of New York City here assembled are glad to respond to President Wilson's appeal in his proclamation of April 15, and will do all in their power to lead and insure the industries they represent to render that patriotic service to the nation which the President has requested."

During the same week, 277 class journals of the United States offered to give to the government editorial co-operation and free advertising space to support government activities in connection with the war. It is proposed by these journals to keep closely in touch with the government in its work and wherever matter of importance develops, which the class journals should lay before their readers, to take measures for its general distribution to them.

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A Call to Service

WITH the entrance of the United States into the world-wide conflict for the preservation of free government and the liberties of mankind, the people of the nation are given the opportunity and privilege to demonstrate that the fundamental principles of democracy, justice and humanity on which the nation was founded and to the preservation of which it owes its growth, must be respected and preserved throughout the civilized world. To accomplish this, the nation's resources in men and wealth must be given without reservation.

To the shipbuilding and shipping industries of the nation the "Proclamation by the President to the People," issued from the White House on April 15, comes as a call for definite service. The need is clearly expressed. "We must supply ships by the hundreds out of our shipyards to carry to the other side of the sea, submarines or no submarines, what will every day be needed there . . . to the shipbuilder, let me suggest the thought that the life of the war depends upon him."

For the nation to utilize its resources in this great conflict the first requisite is overseas transportation. Not only is the need for ships urgent at the present moment, but it will continually become more urgent as the months pass by. To furnish ships we must have not only vastly increased shipbuilding facilities, but also materials, trained shipbuilders, skilled artisans and, what is of equal importance, men to man the ships.

If the vast resources of the mines, forests, workshops and seafaring industries of the country are to be effectively applied to this great task of upbuilding the world's merchant marine, let every man who, by training or experience, is qualified to aid in the development of the maritime resources of the country heed this call and offer his services at once.

Emergency Fleet of Wooden Cargo Ships

OVER 1,000,000 tons of merchant shipping was destroyed by German submarines and mines during the months of February and March this year, and the rate of destruction during April has probably increased. At least considerably more than 5,000,000 tons of merchant shipping has been destroyed by the Central Powers since the war started, and there is every indication that the undersea warfare will be prosecuted by them with increasing vigor during the coming summer months.

To offset these losses there will be a general speeding up of merchant ship construction in the United States, a rapid overhaul of the 600,000 tons of German shipping seized by the Government, and probably a temporary suspension of work on naval contracts which cannot be completed within three years, making available facilities for building at least 500,000 tons of merchant ships in addition to the large volume of business that is now in hand in the steel shipyards on the coasts and Great Lakes.

Together with the extraordinary boom in steel shipbuilding, however, there has also been a remarkable revival in wooden shipbuilding. Over forty wooden shipbuilding yards are now building ocean-going vessels of various types, and the plans of the United States Shipping Board to build an emergency fleet of hundreds of medium-sized cargo boats to aid in carrying foodstuffs, munitions and supplies through the war zone to the Allies means the immediate expansion of the wooden shipbuilding industry.

To build this fleet the United States Shipping Board has organized the United States Shipping Board Emergency Corporation, capitalized at $50,000,000 (£10,250,000), to purchase wooden ships which will be chartered and leased to citizens of the United States to be operated by them in foreign trade. This project has been indorsed by the President, and at his request Major General George W. Goethals, U. S. A., retired, builder of the Panama Canal, has taken charge of the enterprise.

Before entering upon this project the United States Shipping Board made a thorough investigation of the lumber interests and of the smaller machine and boiler shops and steel plants throughout the country to determine the feasibility of securing the necessary materials and propelling and auxiliary machinery for these vessels. As a result, they were able to advise the President and the Council of National Defence that under proper organization it would be probable, without disturbing the steel making or the steel shipbuilding industries, to produce monthly in the neighborhood of 200,000 tons of such shipping each month, beginning at about seven or eight months after the work was undertaken.

The plans provide for the building of vessels of about 3,500 tons deadweight carrying capacity and of about 10 knots sea speed, for which propelling machinery of about 1,500 horsepower will be required for each vessel. It is considered within the range of possibility to produce a fleet of 800 to 1,000 ships of this type within about eighteen months, and that this, combined with the output of steel merchant vessels produced in that time, will exceed or keep pace with the highest rate of submarine destruction, and thus make the German submarine blockade ineffectual.

In carrying out this undertaking it is unlikely that any difficulty will be found in securing the necessary timber, although the supply of seasoned lumber, which would be preferable, will be insufficient, but it is obvious that the resources of the engine, boiler and machinery builders, as well as of the labor market of wood-workers, will be severely taxed.

Plans for one class of wooden cargo boats which have been accepted by the United States Shipping Board, and which have received the highest rating ever granted for wooden vessels by the American Bureau of Shipping, are printed elsewhere in this issue. This design, by William T. Donnelly, of New York, presents a new departure in wooden ship construction in that the principles evolved in the development of steel shipbuilding are directly applied to wooden construction, resulting in a ship far superior in strength and carrying capacity to the type of ship formerly built of wood. The construction is such that practically all parts are standardized, so that the material as received from the mills can be assembled into the ship with a minimum of fabrication at the yard. As undoubtedly a large number of ships for the emergency fleet will be built in accordance with these designs, a careful study of the details as set forth in this issue will be desirable.

As speed of construction is a first requisite in the building of this fleet, all shipbuilders and engine and machinery manufacturers who have facilities adaptable to this work should immediately place their plants at the disposal of the Shipping Board, whose headquarters are in the Munsey building, Washington, D. C. Contracts for this work will be placed by the Emergency fleet corporation and its agents.

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LETTERS TO THE EDITOR

Standardizing Shipbuilding

Standard construction is not a new idea. It is the most striven-for pinnacle of successful manufacture, from needles to engines, and it has not been applied to shipbuilding mainly because there has not been a market for wholesale production.

Retardation in American shipyards has not been due to the want of progressiveness on the part of their managers and owners, but rather to the slackness of demand. The unusual condition of a modern war has developed new shipbuilding opportunity for America and at last there is an incentive for shipbuilding.

Germany and England are reported to have been building standardized vessels for some time in the manner for which some of the American yards are now aiming and have found it the ideal method of quickening construction. The demand for ships was not great enough before this war to require the method to be practiced, but necessity is always the mother of a new contrivance.

The trouble in American yards is that each yard is attempting to standardize its own ship, each yard on different lines. If any degree of permanence is to be established after the war in American shipbuilding it will have to be done through a design of ship fathered by the Government. There would obviously be difficulties if the matter were left to private enterprises in getting owners to agree on a standard specification which would not exist in the case of a Government committee.

What more appropriate organization to develop a real standard ship than the new Federal Shipping Board? It is reported that ample authority will be given to this board for building up and regulating American shipping in the world's trade; then upon its success will rest in a large measure the future expansion of the American merchant marine. But the earnest co-operation and support of all shipping interest will be necessary thereto.

The type of vessel more nearly approaching the needs of all in general seems to be a single-deck steamer designed for purely cargo-carrying purposes, with a depth of about 31 or 32 feet and a deadweight carrying capacity of about 8,000 tons, having virtually no superstructure, and with nothing in its structure that is not absolutely essential for efficient handling and for carrying of general or bulk cargoes.

The fact that it is to be standard in design would facilitate the procuring of material as well as increasing the rapidity of building. With plentiful supplies of material and sufficient skilled labor it is estimated that vessels of this type could be completed in from four to six months.

At the present time the hull of a vessel can be built more speedily than the engine and boilers that go into it. It would be practicable to expedite construction of the engine by increased sub-divisions and standardization. Assuming the adoption of a reciprocating engine of a design that has proven entirely trustworthy and could be turned out by any reputable marine engineering plant, the arrangements could be such that any particular set of engines need not be reserved for any particular hull. If a hull were ready in one yard and a set of engines ready somewhere else they may be brought together to form one ship, so that the delays caused by hulls being in advance of the engines or engines ahead of hulls could to a large extent be avoided.

In the development of the new method it is well to consider the enormous stride made of late in the improvement in the machinery for fabricating ship structural parts, especially the multiple punch and spacing table. By co-operating with the mills, once a standard has been set, the structural shapes and plates instead of being ordered from the mill in the raw form could be ordered to their particular standard and fabricated right at the source of creation and shipped ready to erect, making the yard in reality the erecting or field station.

If the "new" idea and the co-operative enterprise in shipbuilding in this country are to be encouraged, this nation must learn, not how to build ships (there never has been a question that the United States can build ships in competition with the world, as well as in other lines of manufacture), but how to operate them in fair competition with other nations under normal conditions of the sea. In this direction the nation's talents have not been put to the test, because the artificial requirements of law and restrictions have made it more difficult for Americans to operate ships.

T. L. COHEE.
Quarterman Shipfitter, in charge new contruction,
League Island Navy Yard.
Philadelphia, Pa.

Screw Propeller Designing – The Guess vs. the Scientific Method

The fact that many engineers use a great deal of guesswork in connection with propeller designing is well known and is admitted to be so by many of said individuals. Taking this fact into consideration, it seems that such an important part of the vessel as the screw propeller should receive most careful study and attention, in order to produce the very highest efficiency and eliminate all doubt and worry which usually exist where the guess method is predominant. It is true that a fairly good propeller can be designed in many cases by the comparative method, but where the deviations from this method are great, the comparative method is just as good as the old guess method, and as a matter of fact the guess method would be used to a great extent in such a case.

With the above facts staring every naval architect and marine engineer in the face, there are still those who believe that they can design a propeller by the guess method, or comparative method, which will produce the required results, and in many cases they can produce such designs when they have a certain engine power available and a certain form of hull given which compares very favorably with a similar hull for which they have designed propellers before, but they do not stop to realize that a propeller could be designed by proper authorities which would not require as much horsepower and yet would give the same results or better. This leads back to the fact that every engineer and naval architect should keep foremost in his mind that "the propeller should be the starting point for the design of marine propulsive machinery," for it is only after this element is correct that the design of boilers and engines will follow along in logically efficient lines.

The many failures which have existed in connection with propulsive problems have been due to the ignorance of the propeller designer in not realizing the importance of his work, and it is a known fact that approximately 60 percent of the vessels now in use could be made more efficient by a proper design of screw propeller. This fact may seem rather alarming, but it has been found to be true by modern authorities and those who have analyzed many of the propellers designed up to a few years ago. Such failures are sometimes never known, simply because the vessel attains her contract speed, and, furthermore, because an efficient trial trip was never run. This latter

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fact is in most cases true in connection with the wooden motorships, auxiliary schooners, yachts, etc.

In summing up the above as a whole, the question as to "who can design propellers of the highest efficiency" will no doubt arise. The answer to this is very simple, as there are several individuals and one company which make a specialty of the estimation of power for propulsion of vessels and the designing of screw propellers. The services of the above can be secured very readily and at a very moderate cost, and it would be advisable for all those who are interested in eliminating waste of power, time and money to get in touch with said parties and profit by their experience, knowledge and equipment.

The design of a proper propeller, as every engineer knows, is a difficult task, and requires experience, knowledge and equipment; without these assets it is almost impossible to reach the high propulsive efficiency sought for by most engineers and attained by so few.

The above is not meant as a reflection upon the ability or knowledge of the average marine engineer, as the designing of a screw propeller is a very scientific study and requires patience, knowledge and experience; therefore, it is readily seen that unless an individual possesses these assets, he is really not qualified to be entrusted with propulsive problems. Furthermore, the average engineer does not have the time to specialize upon this subject, due to the many other branches of engineering which he is compelled to know. Realizing these facts, it is readily seen that money and doubt would be saved by referring this matter to experts, of which there are a few in this country, as stated before.

Philadelphia, Pa. RAYMOND E. LOVEKIN.

Lloyd George's Speech and Its Relation to Motorship Development

In offering apologies for the late date of discussion of the Prime Minister's speech I must offer as an excuse the great distance that separates America and Great Britain, and the abnormal time that it now takes for mails to twice cross the Atlantic Ocean. I want to draw attention to a part of Mr. Lloyd George's speech, the full purport of which nobody else seems to have grasped:

"Have you been watching what is going on? Before the war we had a good many shortcomings in our business, our commerce, our industry. The war is settling them all right in the most marvelous way. You ask a great business man like my friend, Lord Pirrie, what is going on in those great factories throughout Great Britain and Ireland. Old machinery is scrapped; the newest, the best and the latest is set up; slipshod and wasteful methods are scrapped and hampering customs are discontinued. Millions are brought into the labor market to help to produce who were before purely consumers." (Extract from recent Guildhall speech by Mr. Lloyd George.)

It does not need very close scrutiny to obtain an understanding of what the above words from the lips of Lloyd George must mean to the development and progress of the motorship in the near future. Before the war the number of large Diesel motorships built or building in the British Isles almost could have been counted on the fingers of both hands, for at that time the true worth of the motorship was not fully appreciated by shipowners outside of the European Continent.

War, however terrible it may be, is a wonderful developer, and it has enabled Britain to grasp the full value of the internal combustion engine and its uses are multitudinous. As soon as peace comes I believe Great Britain will make strong endeavors to become the leading Diesel engine and motorship constructor of the world, and in this respect the recent significant words of Sir James Mills and Mr. James A. Milton also may be put forward as a reminder of what will be done by British shipbuilders and engineers. Hardly anything is being done in the United States to meet these probable steps. This is due to two reasons, namely, the apparent unwillingness of American shipowners to "risk" a small portion of the enormous profits now being made, and to the apparent unwillingness of American shipbuilders to undertake the construction of their first Diesel motorships without being assured of making a good profit. They should look at the situation from a different aspect.

It is most unpleasant to display the actions of other countries as a paragon, but in this particular case the striking difference in the attitude of shipowners and shipbuilders, such as the Danes and Norwegians, makes it a necessity. The present spirit in America is not the one that will produce a big merchant navy, and a great mercantile fleet is desired.

In the early days European shipowners placed orders for big motorships, fully aware that such would cost them dearly until the heavy oil engine was perfected, and shipbuilders undertook the constructions, knowing perfectly well that experimenting and developing would cost them far more than the money for such vessels. Both knew that their rewards would come when they had placed several motorships in service, and were content to wait accordingly. Making too much money often makes us selfish. The unselfish position thus taken in Europe has been the means of producing several makes of successful and perfectly reliable sea-going type Diesel oil engines of sufficient power to propel large ocean freighters.

What has America to show?

Nothing!—absolutely nothing tangible!

If American shipbuilders, or shipowners, now desire high-powered marine engines, they will have to buy the experience or the engines from Europe, or else spend years and fortunes in development work. The war, of course, has stopped the allied countries from producing much in the way of motorships to date, otherwise England would have made up for lost time; but I believe operations on a large scale already have been started in Great Britain.

In the extract of Lloyd George's speech it will be noticed that he refers to that great and far-seeing business man, shipowner and shipbuilder, Lord Pirrie. It is Lord Pirrie who has shown in a most emphatic and substantial manner that he is one of the strongest believers in the immediate future of the mercantile Diesel-driven motorship. At one of his great shipyards, where the world's mightiest merchant steamships were built, four big motorships—some reports say seven—are about to be laid down, and four of these will be the largest Diesel-driven vessels in the world. He expresses his confidence, not by building one great vessel, mark you, but by ordering at least four together—the others are for the Elder Dempster Company.

This confidence is based on experience, not on boldness alone, because one of the great shipping interests controlled by him has sold all its steamers and replaced them with Diesel motorships. Let us give him credit for knowing the shipping business from A to Z.

Furthermore, it is through Lord Pirrie interests that a small European steamship building yard has become one of the most important mercantile motor shipyards in the world. *This yard now has its capacity booked for six years ahead entirely with Diesel motorships. No steamship yard in the world is in such a fortunate position.*

(Concluded on page 212)

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Problem of the Wooden Cargo Ship

Description and Calculations Relative to Construction of 5,500-Ton Deadweight Carrying Capacity Cargo Vessel

BY WILLIAM T. DONNELLY *

THE plans and information submitted herewith relative to a wooden ship of dimensions and carrying power much beyond anything hitherto constructed are the result of many years given to the study and investigation of this problem, and are not to be considered in any sense a war measure. In fact, the plans as here presented, together with the calculations, were almost, if not quite, complete before the present agitation for wooden ships was brought about by unrestricted submarine warfare.

The writer's attention was directed to the problem of the wooden ships by investigations and developments in the application of wood to floating dry docks, which in the last twenty years has resulted in the building of these structures up to a carrying power of 20,000 tons.

* Naval architect, 17 Battery Place, New York City.

The problem as here presented is believed to be a thoroughly scientific and practical solution of the use of wood as an engineering material for ship construction, and the plans as here presented have received very careful review and criticism by engineers of the highest standing. The fact that they have been passed by the American Bureau of Shipping for their highest rating would seem to entitle them to every consideration. The writer, however, presents them entirely upon their own merits and invites criticisms from all parties at all interested.

Longitudinal Strength

The vessel shown in the plans is 350 feet long between perpendiculars, 50 feet beam and 30 feet molded depth, with a deadweight cargo-carrying capacity of 5,500 tons.

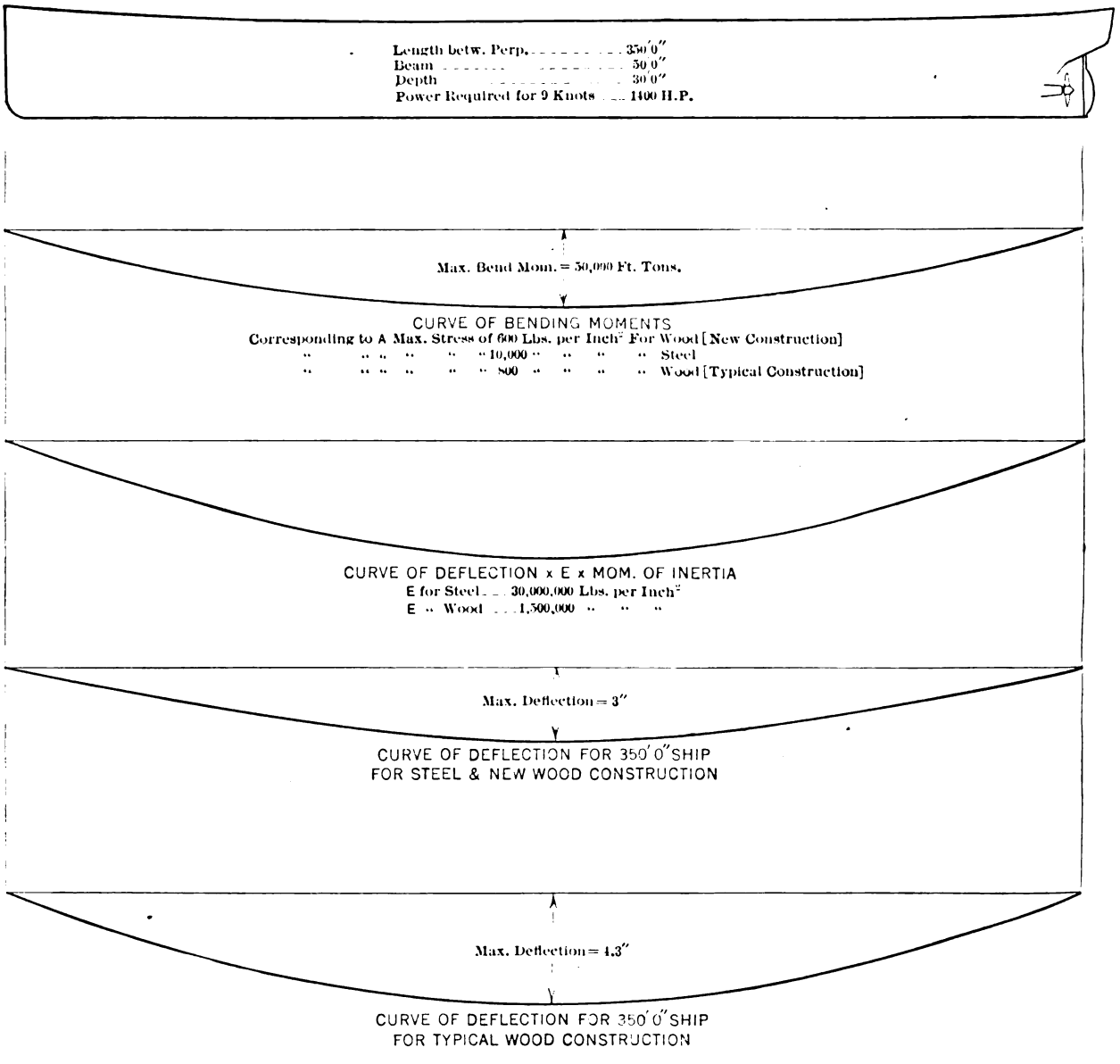
Length betw. Perp. . . . . 350'0"
Beam . . . . . 50'0"
Depth . . . . . 30'0"
Power Required for 9 Knots . . . 1400 H.P.
Max. Bend Mom. = 50,000 Ft. Tons.
CURVE OF BENDING MOMENTS
Corresponding to A Max. Stress of 600 Lbs. per Inch² For Wood [New Construction]
" " " " " " 10,000 " " " " Steel
" " " " " " 800 " " " " Wood [Typical Construction]
CURVE OF DEFLECTION x E x MOM. OF INERTIA
E for Steel . . . 30,000,000 Lbs. per Inch²
E " Wood . . . 1,500,000 " " "
Max. Deflection = 3"
CURVE OF DEFLECTION FOR 350'0" SHIP
FOR STEEL & NEW WOOD CONSTRUCTION
Max. Deflection = 4.3"
CURVE OF DEFLECTION FOR 350'0" SHIP
FOR TYPICAL WOOD CONSTRUCTION

Fig. 1.—Longitudinal Deflection Diagrams, Showing Comparative Longitudinal Strength and Rigidity of Steel and Wooden Hulls

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For the longitudinal strength and deflection, see Figs. 1-4. In these figures will be seen a typical section of a steel double bottom ship of similar dimensions to the wooden hull under consideration, and the weight of plates assigned to this midship section has been taken from Lloyds rules for scantlings, and the center of gravity, moment of inertia, and other mathematical functions are set forth with reference to each hull, and also with reference to the typical ship construction increased to the dimensions under consideration.

On the section of the proposed new hull there is shown the thickness of planking and timbers to be used, together with indication showing where edgebolting of timbers is required—also the arrangement of a double wooden bottom carried up around the bilge, and longitudinal division of double bottom to stiffen it locally.

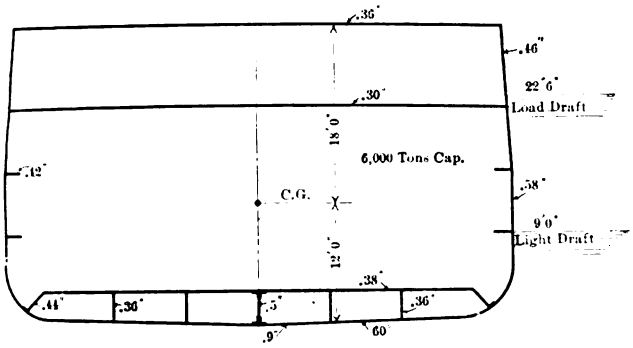

Fig. 2.—Section of Steel Hull

Working Stress.—10,000 pounds per inch.[2]
Moment of Inertia.—25,000,000 inch.[4]
Section Modulus.—116,000 inch.[3]
Resistance Mom.—50,000 foot-tons.

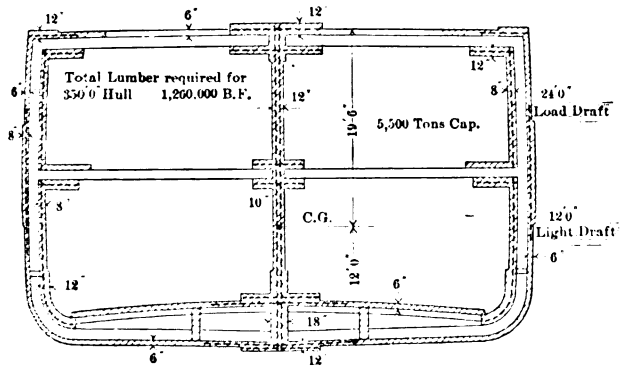

Fig. 3.—New Construction—Section of Wooden Hull of Equal Strength and Stiffness as Same Size Steel Hull

Moment of Inertia.—500,000,000 inch.[4]
Working Stress.—600 pounds per inch.[2]
Section Modulus.—2,135,000 inch.[3]
Resistance Mom.—50,000 foot-tons.
Effective Area of Section.—200 square feet

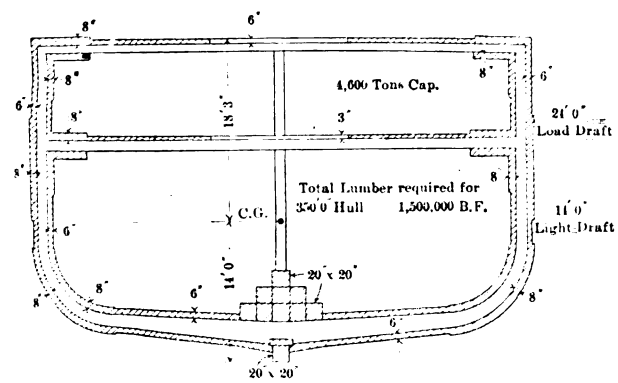

Fig. 4.—Section of Wooden Hull—Typical Construction

Moment of Inertia.—350,000,000 inch.[4]
Section Modulus.—1,600,000 inch.[3]
Resistance Mom.—37,000 foot-tons.
Effective Area of Section.—175 square feet.

It will be understood that every eighth bottom truss is to be filled in, making it a transverse bulkhead within the double bottom.

In Fig. 1 are shown the longitudinal deflection diagrams, giving information relative to the comparative longitudinal strength and rigidity of the hulls. In working these out I have used the modulus of elasticity for steel of 30,000,000, and for wood 1,500,000 pounds.

For the steel hull the deflection was worked out to correspond with a maximum stress of 10,000 pounds per square inch, upon the material of the midship section, and was found to be 3 inches; and then a similar calculation was applied to the midship section of the wooden hull to determine the stress per square inch for the same deflection, and this was found to be 600 pounds.

Factor of Safety of Wooden Ship

In comparing these results, it should be noted that a working stress of 10,000 pounds per square inch for steel compared with an ultimate strength of 60,000 pounds, gives a factor of safety of 6, while a working stress of 600 pounds per square inch applied to wood as compared with an ultimate strength of from 8,000 to 10,000 pounds gives a factor of safety of something more than 12. A further analysis of this result would be to state, that to obtain the corresponding rigidity in a wooden structure to a similar one of steel, it is only necessary to use a working fiber stress less in proportion to the ultimate strength, but this statement should be qualified by the possibility of using the engineering device more fully explained later on—that is, of so organizing the structure as to put the component parts under initial stress.

The remaining considerations, from an engineering point of view, are the practical and detail methods of uniting the wooden members by iron fastenings to develop the full strength of the wood as a structural material.

From twenty years' experience in the design of floating dry docks, I am prepared to state that I have found it entirely practical to develop (by fastenings in timber structures) as near an approach to the full section value as is possible with steel.

Timbers Given an Initial Stress

Attention is called to the fact that in forming the midship section, including double bottom, sides and deck, all timbers are of uniform section throughout their length, and all are given an initial stress, although well within their elastic limit. This is a well-known engineering device to obtain initial rigidity of structure, it being well understood that materials put together in this manner will be much more rigid, maintaining their form until applied stress has passed beyond the initial stress, and this without in any way sacrificing resistance to maximum stresses.

The main feature of this construction is the center bulkhead running continuous from stem to stern post, the material of which is disposed according to the well-known theory of I-beam or plate girder construction, which gives the greatest amount of strength and rigidity for the weight of material used. This construction requires the placing of hatches in pairs on either side of the center bulkhead, and it is proposed to make them 12 feet in width and 28 feet in length. Any reasonable departure from these figures for special requirements can be readily made.

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By referring to Plate 1 it will be seen that in addition to the center bulkhead, other practically watertight bulkheads are to be provided as follows:

Collision bulkhead 35 feet from the bow; a machinery bulkhead at a distance from the stern corresponding to the requirements of whatever type of machinery is used,

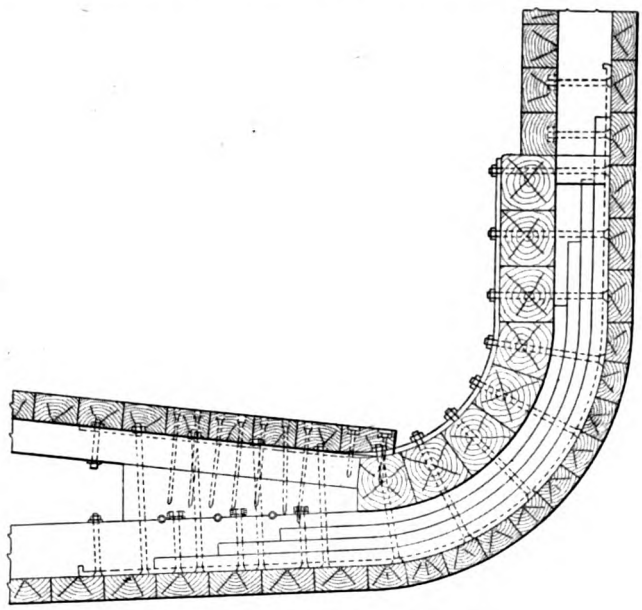

Fig. 5.—Detail of Bilge Construction

and two intermediate bulkheads dividing the cargo space into six watertight divisions. This arrangement of bulkheads divides the ship into ten watertight compartments, which, together with the double bottom, would make the ship practically unsinkable under all ordinary conditions.

It is to be understood that it is entirely practical to make communication openings of wood construction that shall be dependable as watertight doors for entirely cutting off any or all of these compartments, and that there is no practical difficulty whatever in giving the bulkheads ample strength.

Referring to Fig. 5, there will be seen an enlarged detail of the bilge construction. This has been worked out along construction lines which are well known in the highest class of small boat construction, and which can be readily carried out by ordinary workmen in a rapid and efficient manner.

Transverse and Local Stresses

The calculations relative to local stress in bottom, sides, deck, etc., as is usual in the investigation of ships' stresses (with such scantlings as are necessary to take care of overall, or what might be called girder stresses in ships), are much more than necessary to take care of local stresses due to water pressure, cargo distribution, and other local considerations.

The local stress diagrams and explanations inserted herewith are for those more particularly interested in the mathematical consideration of this design.

Transverse Strength

(For sections, see Fig. 6)

A. Double Bottom

Section *A-A* is a combined longitudinal bottom section.

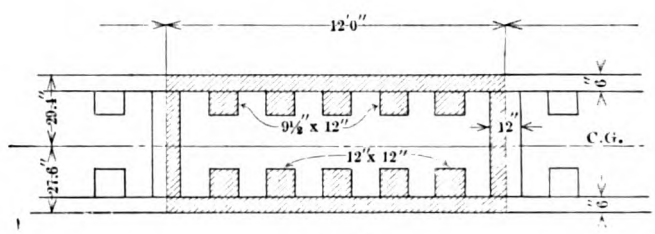

Fig. 7

Maximum Fibre Distance from C. G. ..... 29.4 inches
Moment of Inertia ..... 1,551,456 inches⁴
Section Modulus ..... 52,770 inches³

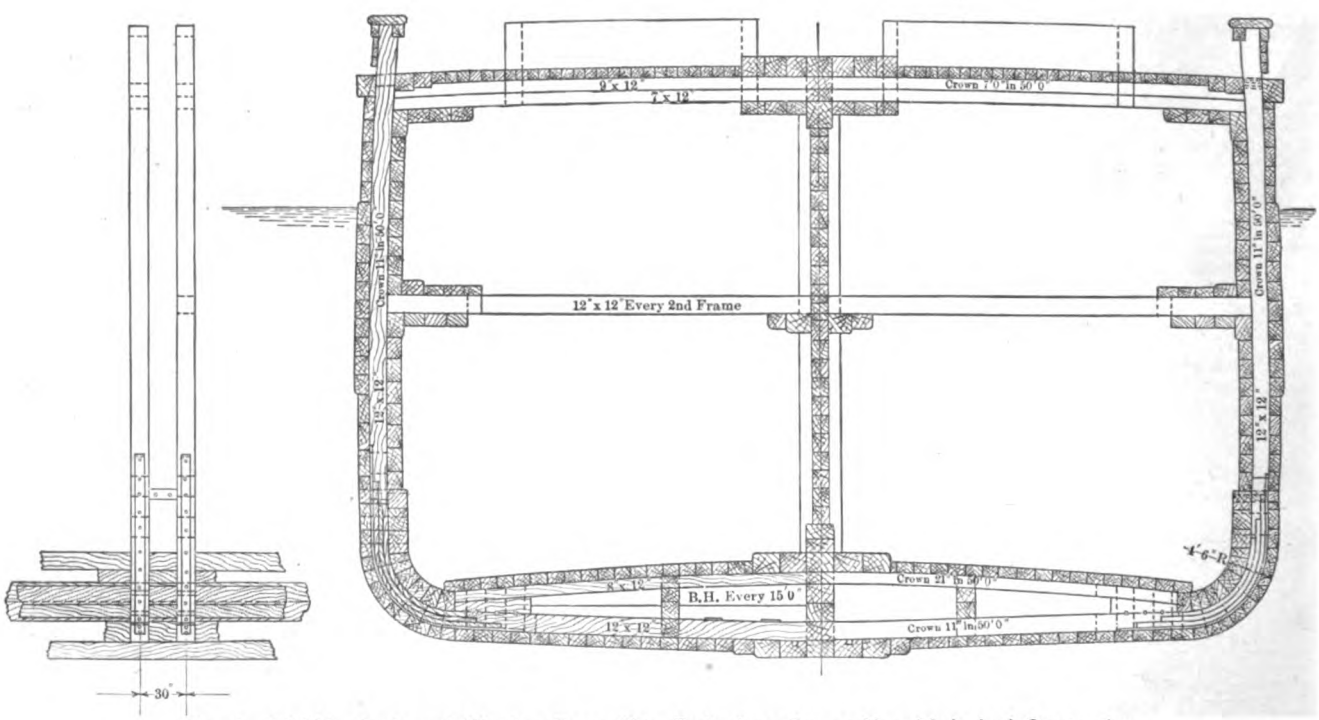

Fig. 6.—Midship Section of Wooden Cargo Ship Built According to New Method of Construction

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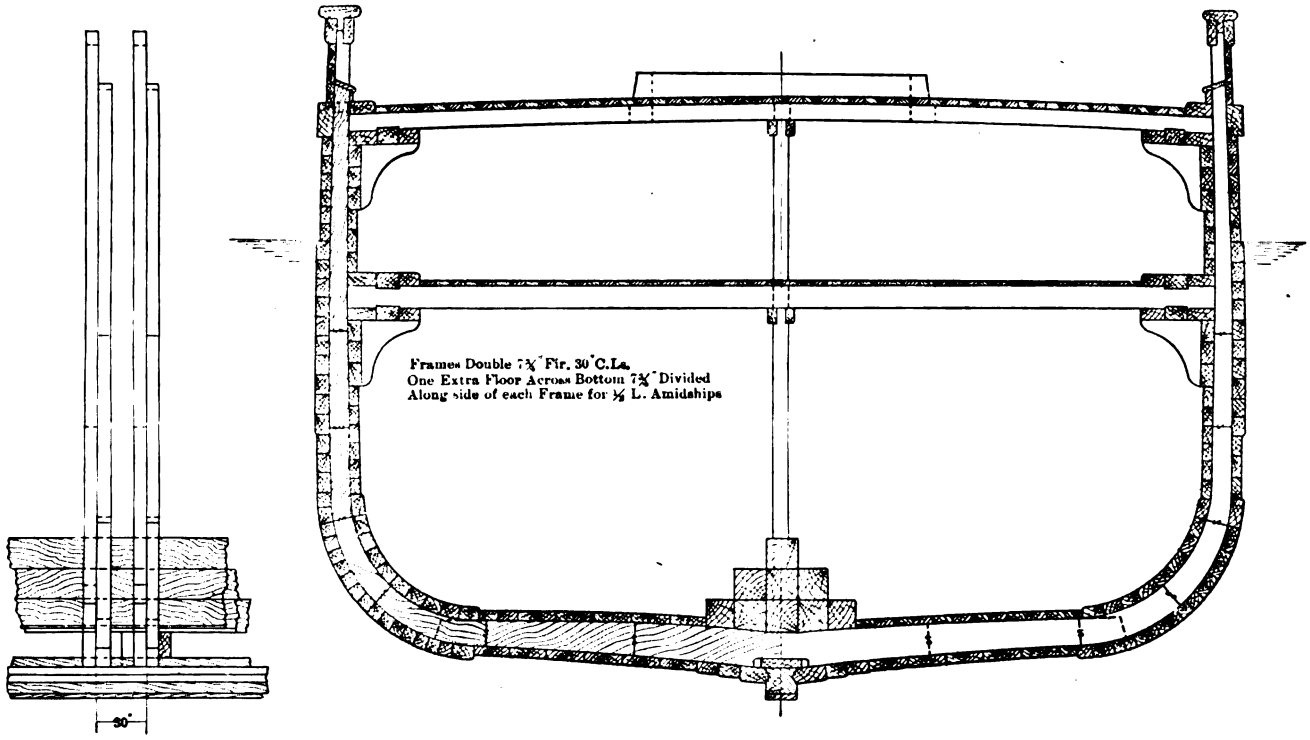

Fig. 8.—Midship Section of Wooden Cargo Ship—Present Typical Construction

Conditions of Loading:

A beam clamped at one end and supported at the other, subjected to an evenly distributed direct load and also to a bending moment applied at its free end.

Span ..... 25 feet
Bending Load (Pressure-Weight) ... 600 pounds per foot²
Total Bending Load ..... 18,000 pounds
Moment at Clamped End ..... 342,000 foot pounds
Moment at Free End ..... 325,000 foot pounds
Maximum Moment ..... 667,000 foot pounds
Section Modulus ..... 52,770 inches³
Stress ..... 152 pounds per inch²

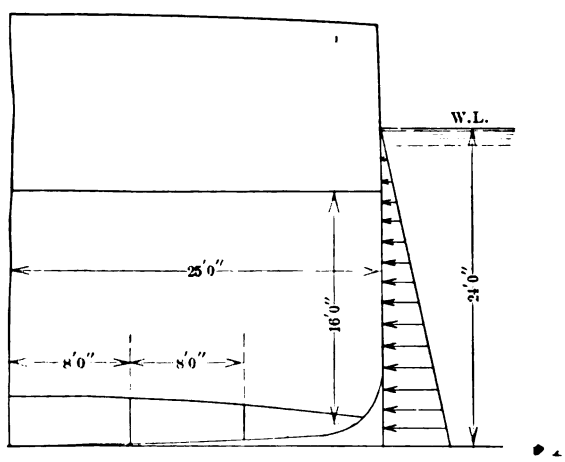

Fig. 9

Section *B-B* is a section taken through the bottom stringer of the double bottom.

Maximum Fibre Distance from C. G. ..... 10.5 inches
Moment of Inertia ..... 8,000 inches⁴
Section Modulus ..... 762 inches³

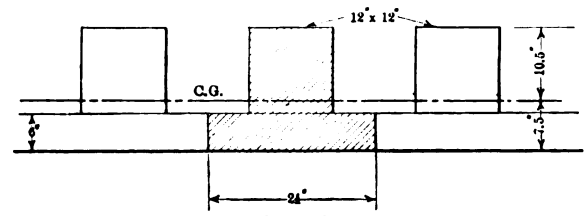

Fig. 10

Conditions of loading:

A beam clamped at both ends supporting an evenly distributed load.

Span ..... 8 feet
Bending Load (Pressure-Weight) .. 1,500 pounds per foot²
Total Bending Load ..... 24,000 pounds
Maximum Moment ..... 16,000 foot pounds
Section Modulus ..... 762 inches³
Tension ..... 250 pounds per inch²
Compression ..... 180 pounds per inch²

Section *C-C* is a section taken through the top stringer of the double bottom.

Maximum Fiber Distance from C. G. ..... 9 inches
Moment of Inertia ..... 4,800 inches⁴
Section Modulus ..... 533 inches³

Conditions of Loading:

A beam clamped at both ends supporting an evenly distributed load.

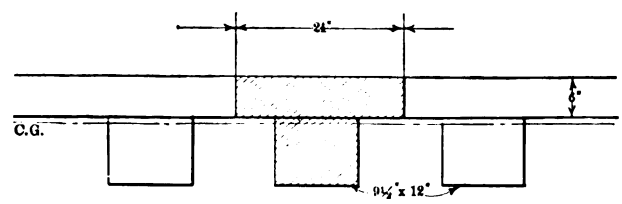

Fig. 11

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Span .....8 feet
Bending Load .....800 pounds per foot²
Total Bending Load.....12,800 pounds
Maximum Moment .....8,530 foot pounds
Section Modulus .....533 inches³
Tension .....192 pounds per inch²
Compression .....139 pounds per inch²

B. Siding

Section *D-D* is a section taken through the siding frame.

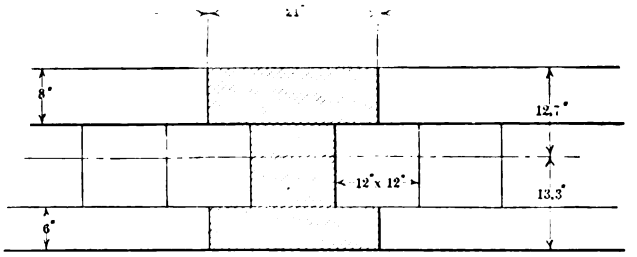

Fig. 12

Maximum Fibre Distance from C. G.....13.3 inches
Moment of Inertia.....33,000 inches⁴
Section Modulus .....2,480 inches³

Conditions of Loading:

A beam clamped at both ends carrying an increasing load.

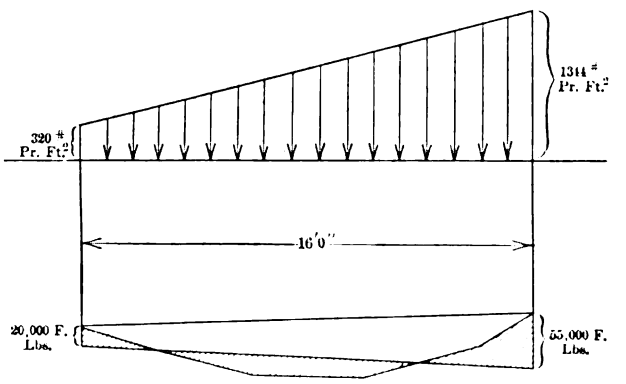

Fig. 13

Span .....16 feet
Bending Load .....320 to 1,344 pounds per foot²
Total Bending Load.....27,000 pounds
Maximum Moment .....55,000 foot pounds
Section Modulus .....2,480 inches³
Tension .....324 pounds per inch²
Compression .....310 pounds per inch²

Section *E-E* is a section taken through the laminated knee.

Maximum Fibre Distance from C. G.....13.5 inches
Moment of Inertia.....16,500 inches⁴
Section Modulus .....1,222 inches³

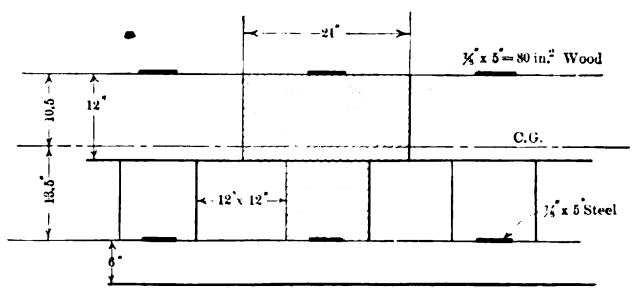

Fig. 14

Conditions of Loading:

Bending only.

Maximum Moment.....55,000 foot pounds
Section Modulus .....1,222 inches³
Tension .....540 pounds per inch²
Compression .....378 pounds per inch²

C. Decking

Section *F-F* is a section taken through the deck frame.

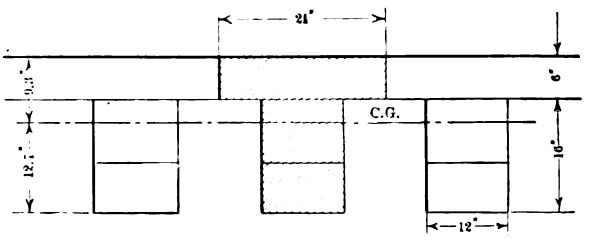

Fig. 15

Maximum Fibre Distance from C. G.....12.7 inches
Moment of Inertia.....18,800 inches⁴
Section Modulus .....1,480 inches³

Conditions of Loading:

A beam clamped at both ends and supporting an evenly distributed load.

Span .....23 feet
Allowable working stress.....600 pounds per inch²
Section Modulus.....1,480 inches³
Resistance Moment.....74,000 foot pounds
Allowable Floor Load.....655 pounds per foot

Construction of Bilge

Referring particularly to the laminated bilge, I would call attention to the fact that it is the segment of a circle, the radius of which is the same for the entire length of the bilge. Due to this important consideration, it is possible to run out the bilge planking to exact curvature and side bevel to properly fit the bilge, and it is equally possible to finish the heavy inner section in the same mechanical manner, and by providing a substantial iron strap on the outside of the laminated member and on the inside lining, it is possible to connect the side and double bottom into a solid rigid structure, and to make impossible the working of the bilge, which has been known for all time to have been one of the weakest points in wooden construction. It should also be noted that by giving the wooden ship the same general hull form as the steel ship, the depth of the side and its corresponding strength have been much increased.

Double Bottom

The double bottom as applied to this construction has been worked out with a full knowledge of all the practical difficulties to be overcome in making wooden compartments and subdivisions watertight in floating dry dock construction, and while all details are not set forth, it is to be understood that they are all well within the practical limits of wood construction.

Speaking generally, the working or yielding of the wooden ship as previously designed was due primarily to a lack of longitudinal rigidity due to an inadequate strength at the center line, much increased by the considerable dead rise given to the floors, the large curvature of the bilge necessary to obtain even a very inadequate strength of sawed frames, weakened by short lengths and cross grain. The working of the bilges was also partially due to the fact that the bow and stern would come in or yield when the whole structure was put under stress.

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The introduction of the center line bulkhead as a plate girder not only adds strength where it was most needed, but entirely prevents the possibility of the bow and stern yielding—in other words, it reinforces the sides in addition, and when these facts are taken into consideration, with the very great increase in rigidity of the bilge and the increased depth of the sides, the fundamental reasons for anticipating a rigid wooden hull of much larger dimensions are fully sustained.

APPLICATION OF PROPELLING POWER

Referring to Plate II, there will be found diagrammatic illustrations of different forms of power equipment which may be applied to the propulsion of this hull.

Primarily, it is the intent to give the hull a speed of 9 knots loaded and 10 knots light, and this will require the expenditure of approximately 1,400 indicated horsepower, or 1,200 brake horsepower as applied to the propeller shafts.

It is first to be noted that twin screw propulsion is provided under all methods of construction, and that the uniform rotation of propeller shaft of 125 revolutions per minute has been adopted, which would correspond to a diameter of 10 feet for each propeller.

STEAM PROPULSION

In case of steam propulsion, it is to be noticed that a length of hull measuring from the stern of 111 feet will be required for engines, boilers and coal bunkers, and that provision is made for carrying 500 tons of coal giving a radius of 5,000 miles.

In case of use of oil for fuel, a considerable reduction in fuel space and weight of fuel to be carried will be effected, but the space required for machinery would not be materially affected. A geared steam turbine might be used in place of reciprocating engines with a small reduction in weight per horsepower, but this reduction would not affect the boilers, and the weight to be saved is not large.

The total weight of machinery, including engines and boilers, shafting and propellers, would amount approximately to 325 tons. This, referred to indicated horsepower, would mean 464 pounds per horsepower.

DIESEL ENGINE PROPULSION

Diesel engine propulsion, with two 600 brake horsepower Diesel engines direct connected, operating at 125 revolutions per minute, would require a space corresponding to 106 feet length of hull. The total weight of machinery would be 285 tons, or 475 pounds per brake horsepower. Provision has been made for 300 tons of oil, which would give a radius of 9,000 miles.

This method of propulsion is fairly well known and offers very great economy in fuel and provides for very large radius of action. The weight of the machinery, however, is fully as much as steam machinery, when the engines are built of sufficient size to operate at the same number of revolutions, which is essential for equal service.

ELECTRIC PROPULSION

A third method is shown in which two oil engines of a semi-Diesel type are used to operate two 500 kilowatt electric generators, at 350 revolutions per minute, and the ship is propelled by two 600 horsepower electric motors running at 500 revolutions per minute, geared to propeller shafts making 125 revolutions per minute. This mechanical equipment shows a total weight of 214 tons or 305 pounds per horsepower. The very considerable reduction in total weight of machinery required is due to the highest speed of oil engines, and it is seen that the reduction in the weight of these engines more than overbalances the weight of electric generators and motors.

A fourth equipment is shown in Fig. 4, Plate II, consisting of four 350 brake horsepower oil engines operating at 500 revolutions per minute, each driving a 250 kilowatt generator, the propulsion of the ship being by two 600 horsepower electric motors, the same as in the previous equipment.

The total weight of this equipment is 182 tons, or 260 pounds per horsepower, and in connection with it there has been shown fuel oil tanks holding 250 tons giving a radius of 7,000 miles.

The comparison of the space occupied by the electric machinery with other forms of drives shows that it will require very much less room, and that with the smaller high speed units (the least of all, in fact) the power generating plant could be put in half the space, and the four units would require but one man on watch to care for them. Each of the units is so small that it could be readily overhauled and the spare parts to be carried would be few and light.

It should be pointed out that while in port any one of the four units could furnish all the auxiliary power necessary for handling cargo, pumping and lighting the ship, and for doing any other work, and that with a liberal equipment of electric pumping machinery, any part or all of the propelling power of the ship could be used to pump the vessel in an emergency.

It is not claimed that any of these equipments represents the final word of power application, but they do furnish a reasonably accurate basis for the comparison of different methods, and indicate the lines along which study and development should be made.

It is very plain, if anything like one thousand ships are to be built and equipped with power propelling machinery, that no one method can be applied to all, and that to make the greatest progress every practical method must be applied. Furthermore, it would seem that, where such a large number of vessels of practically the same size and construction are to be created, every method of propulsion promising any real possibilities in competition with any other should be given an opportunity. With a careful record, a very great deal of positive knowledge can be obtained as to the relative merits of different methods of propulsion.

United States Battleship New Mexico Successfully Launched at New York Navy Yard on April 23

Contrary to the usual custom in times of peace, the latest United States battleship to leave the builders' ways was launched in the presence of only a comparatively few spectators, although the appropriate ceremonies were observed. This latest addition to the nation's first line of defense is the superdreadnought *New Mexico* building at the New York Navy Yard, Brooklyn, N. Y., under the direction of Naval Constructor G. H. Rock, U. S. N. The vessel was launched on April 23, and christened by Miss Margaret de Baca, daughter of former Governor de Baca, of New Mexico.

The principal dimensions of the *New Mexico* are as follows: Length, 624 feet; breadth, extreme to outside of frame, 97 feet 4½ inches; displacement, 32,000 tons; mean draft, 30 feet. Her armament consists of twelve 14-inch

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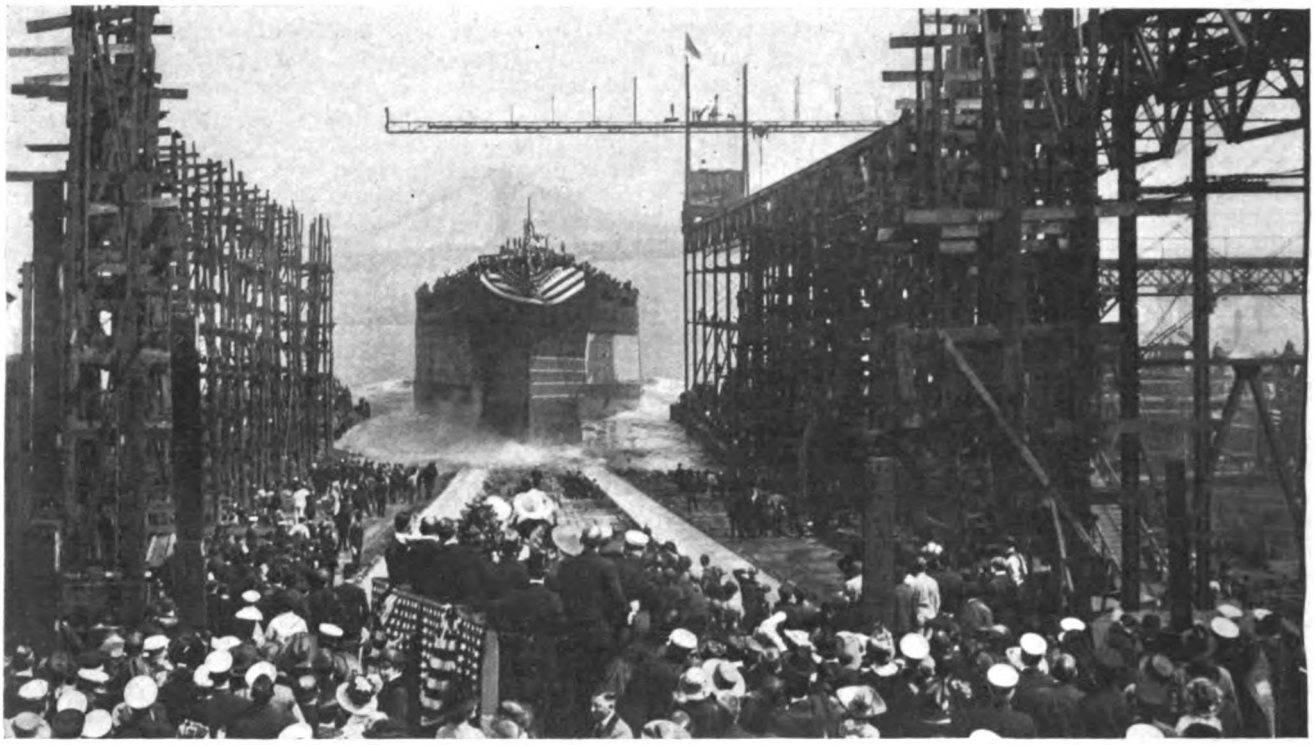

U. S. S. *New Mexico* Leaving the Building Ways at the New York Navy Yard, Brooklyn, N. Y.

guns, twenty-two 5-inch, four 3-pounders, four anti-aircraft guns and two torpedo tubes. She will be manned by fifty-six officers and 1,141 men.

The *New Mexico* is a sister ship of the *Mississippi* recently launched at the yards of the Newport News Shipbuilding & Dry Dock Company and of the *Idaho* still on the ways at the works of the New York Shipbuilding Corporation, Camden, N. J. The keel of the *New Mexico* was laid on October 14, 1915, and, when launched, she was about 67 percent completed. It is expected that the vessel will be finished within the thirty-six months specified at the time the keel was laid.

The last vessel launched from the New York Navy Yard was the battleship *Arizona*, launched in June, 1915. The *Arizona* was 608 feet long and of about 1,000 tons less displacement than the *New Mexico*. The main battery in both of these ships, however, is the same and the speed will be approximately the same. The *New Mexico*, however, will be equipped with electric drive.

Lloyd George's Speech and Its Relation to Motorship Development

(*Concluded from page* 205)

What does it portend? It shows that there are certain shipowners who will not take the risk of placing orders for steamers with delivery in over three years' time, but who have sufficient confidence in the Diesel motorship to accept deliveries four, five and six years ahead!

Does it not also show that Lord Pirrie and these neutral European shipowners realize that, no matter what state the shipping business may be in in six years' time, it is certain that motorships can be successfully and profitably operated in the face of any kind of steamship service? These shipowners are not new introductions of young blood into the business whose motto is "everything modern, no matter how heavy the cost"; but are serious-minded and venerable shipowners with several decades of hard experience before them. Those who followed Lord Pirrie in the past have made fortunes, those who follow him now also will make fortunes. If Lord Pirrie says motorships are practical you can be sure that they are so. He owns enough to know. He also owns steamers. America has only tried steamers, so is without proper experience. Will Americans merely shrug their shoulders and proceed about their business thinking they know better than he? Either he is right and they are wrong, or they are right and he is wrong! Which is it?

In view of this I may well ask shipowners and shipbuilders of the United States, "What are you doing?" Let us all again read Lloyd George's significant words, watch Lord Pirrie's doings, and then act upon them! The shipbuilders and shipowners of Great Britain have agreed to pool their motorship and Diesel-engine knowledge, also to obtain Government assistance in research work, and have set themselves to make the British marine oil engine the world's standard. American shipowners today are wealthy. Let them cut out the "playing safe" motto in this connection. Let us all do our bit! Also let the shipowning oil companies make the first worthy start. They will benefit the most.

T. O. LISLE.

Shipbuilders Form an Advisory Committee on Naval Architecture at the Massachusetts Institute of Technology

President Richard C. MacLaurin, of the Massachusetts Institute of Technology, Boston, Mass., has received acceptances from the following shipbuilders to serve as an advisory committee on Naval Architecture at the Institute. The shipbuilders who will comprise this committee are as follows: Joseph W. Powell, president Fore River Shipbuilding Corporation, Quincy, Mass.; Homer L. Ferguson, president Newport News Shipbuilding & Dry Dock Company, Newport News, Va.; Charles P. Wetherbee, vice-president Bath Iron Works, Bath, Me.; James Swan, general manager Herreshoff Manufacturing Company, Bristol, R. I., and George J. Baldwin, president New York Shipbuilding Corporation, Camden, N. J.

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Douglas Fir (Oregon Pine) Shipbuilding

Supply of Douglas Fir—Properties and Strength of the Material —Application to Shipbuilding and Methods of Construction

BY HOWARD B. OAKLEAF *

DURING the last year or eighteen months the shipbuilding industry of the world has received phenomenal impetus owing to the exceptional demand for bottoms to replace those destroyed and interned since the beginning of the European war. Ships are being sunk more rapidly than they can be rebuilt with present facilities for construction and it will be several years before the demand for vessels of all classes will be met.

Within the last thirty years steel shipbuilding has caused the wooden shipbuilding industry gradually to decline, until in recent years such yards have, with but few exceptions, been called upon to build only small commercial boats and pleasure craft. Fortunately such work gave employment to sufficient skilled workmen to form the nucleus of the vast army of men now being employed in this class of work. In addition, there are quite a number of skilled shipbuilders who have taken up other trades that are now available for the revivification of this waning industry.

The enormous demand for both war and merchant vessels has so overtaxed the steel shipyards, and in turn the already overworked steel manufacturers, that the cost of steel vessels has risen by leaps and bounds, yet the demand for such tonnage cannot be met. This peculiar condition in the steel shipyards is largely responsible for the ready markets for wooden vessels at the present time, although improvements in design and in methods of construction have undoubtedly played an important part in the revival of the wooden ship industry.

Both pure sailing vessels and vessels equipped with auxiliary steam or internal combustion engines are being built in considerable numbers, the latter being the prevailing type. Most of them are designed for carrying lumber, although many will probably be used for other cargo. They are generally of the twin screw type and powered to make a speed of six or eight knots in calm weather, when loaded. The auxiliary power is a saving and a convenience when shifting berth and to prevent being becalmed.

The capacity of most of those under construction at the present time is from 1,000,000 to 1,500,000 board feet of lumber, although some of larger capacity up to 2,250,000 board feet are being built.

It is principally the auxiliary schooner that is discussed in this paper, although much of the text is applicable to wooden ship construction in general.

Supply of Raw Material

In the Western timbered area of the States of Oregon and Washington there are now standing about 450,000,000,000 feet of Douglas fir (Oregon pine) trees, representing an almost unlimited supply of wood admirably adapted to the construction of wooden vessels, as is later shown by the discussion and data on the mechanical and physical properties of this important tree species. It is this remarkable supply of suitable raw material which is attracting and will continue to attract shipbuilders to this region. In addition to the abundance of raw material which insures a reasonable price for the wood for years to come, the trees grow to such an unusual size, commonly 3 to 5 feet in diameter and 175 to 250 feet high, that the shipyards can always obtain on short notice huge sticks of almost unheard-of dimensions at comparatively low cost. This means that even the largest of wooden boats can be constructed of Douglas fir with minimum splicing, which not only reduces labor costs but materially increases the strength or seaworthiness of the vessel, since man cannot fabricate the material as successfully as nature.

The large supply of raw material not only assures almost indefinite availability at a reasonable price, but it enables the boat builder to purchase his timbers from those operators who are cutting a class of trees the wood from which is especially suited to the construction of vessels. This is not possible to the same extent anywhere else in the world.

Mechanical and Physical Properties of Douglas Fir (Oregon Pine)

Douglas fir is exceptionally strong for its weight, a factor more important in the shipbuilding industry than in most any other business that requires large quantities of this species, although it is a great asset in the construction of railway freight cars. In both of these wooden structures it is important that the material used be as light as the desired strength will permit, since all surplus weight greatly reduces the speed and increases the cost of transporting commodities in them. Douglas fir is one of the few woods whose strength is above the values set by the well established law of weight vs. strength.

The strength values presented below are the result of exhaustive tests made by the Forest Service, U. S. Department of Agriculture, at its various timber testing laboratories. They are for both green and air dry stock and for both large and small specimens.

STRENGTH OF DOUGLAS FIR*

	Large Select Beams 8 x 16		Large Merch. Beams 8 x 16		Small Clear Beams 2 x 2	
	Green	Air Dry	Green	Air Dry	Green	Air Dry
Moisture, percent	....	21.4	....	21.2	35.4	18.8
Fibre stress at elastic limit, pounds per square inch	4,346	4,690	3,895	4,625	4,920	6,300
Modulus of rupture, pounds per square inch	6,753	7,070	5,878	6,472	7,800	10,000
Modulus of elasticity, pounds per square in., in thousands	1,654	1,644	1,481	1,567	1,580	1,680
Impact bending—drop of 50-pound hammer to break			2" x 2" x 28"		25"	28"
Compression parallel to grain—crushing strength at maximum load, pounds per square inch					3,910	4,850
Compression perpendicular to grain—fibre stress at elastic limit, pounds per square inch					530	760
Hardness on end—load in pounds required to imbed a 0.444-inch ball to half its diameter					510	650
Hardness on side—load in pounds required to imbed a 0.444-inch ball to half its diameter					510	610
Shearing strength—parallel to grain, pounds per sq. inch					870	940

N. B.—The above strength of figures of the air dry material would be higher if the wood had been dried more, but they are well adapted to boat design.

Weight.—Douglas fir has an average specific gravity of .53, based on its oven dry volume, or .46 when based on its green volume (before shrinkage), and .48 on its air dry volume. The green wood weighs 38 pounds per cubic foot

* In charge office of Forest Products, United States Forest Service, Portland, Ore.

* F. S. Bulletin No. 88, page 56, and M. S. Reports, Project L-124 and Project L-140.

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(3.166 per board foot) and the air dry wood 34 pounds (2.833 per board foot). These weights vary in fir as in other woods, but the above figures are reliable averages.

Durability.—Douglas fir is a durable wood, although, like other woods when used for this purpose, precautions should be taken at the time the boat is constructed to see that preservatives are effectively applied and that the necessary amount of ventilation is supplied to prevent the collection of moist, stagnant air in any part of the vessel.

Shrinkage.—Douglas fir does not shrink much, and for this reason it is possible to use partially dried material in emergencies without fear that additional drying after the material has been shaped will open the seam or cause undesirable stresses in the members. The following figures are given for the information of those desiring to know the amount that Douglas fir will shrink under normal conditions from green to air dry: Radially, 1.52 percent; tangentially, 2.37 percent, and longitudinally, 0.0091 percent.

Abrasion.—While there are no reliable test data on the resistance of Douglas fir to abrasion, it is a well-known fact that this wood has long given satisfaction as decking for all kinds of vessels, both wooden and steel. Shipbuilders from all over the world buy millions of feet of vertical grain Douglas fir decking annually.

Workability.—The wood is easily worked with all classes of cutting tools used in the shipbuilding trade, and ship carpenters who have had experience with various woods are highly pleased with the ease with which they can carve and saw the large fir timbers.

Bending.—When the wide, thick pieces of planking and ceiling have been properly steamed, they become quite pliable and can be bent readily to conform to the ship's lines.

Painting.—Douglas fir takes paints well and can also be stained and polished nicely. These characteristics make it well adapted to either outside or inside finish. So well does it meet the requirements of woods used for interior trim that many boats are built entirely of fir.

Douglas Fir Ship Knees

In addition to the large timbers and planks obtainable from Douglas fir trees, the stumps yield the finest and largest ship knees in the world. These knees are an important item to the shipbuilder for as many as two hundred to three hundred are used in a single boat. Most of

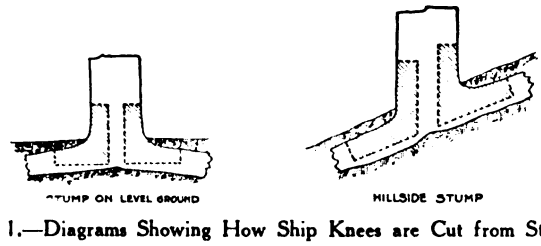

Fig. 1.—Diagrams Showing How Ship Knees are Cut from Stumps

the knees have an angle of ninety degrees, although a few are used for special purposes that require angles greater or less than this. Stumps on level ground yield knees having right angles, while the roots of those on a hill produce knees with acute angles on the uphill side, and obtuse knees on the down-hill side.

Masts and Spars

For many years the large masts and spars for vessels built in various shipyards of the world have been supplied from the Douglas fir forests of Washington and Oregon. Here, as in the other parts of the boats, the strength, weight and size of the sticks have been of inestimable value to shipbuilders in getting out these essential parts of both sailing and power vessels. Masters of vessels flying all flags have taken the opportunity when calling at Oregon and Washington ports, of picking up an extra mast or spar.

The trees carry their form well up into the top, and masts can be obtained from young, thrifty trees without

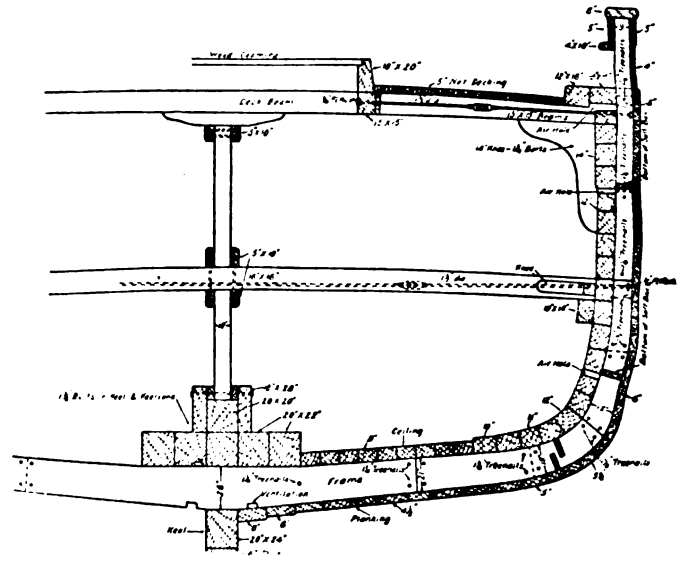

Fig. 2.—Midship Section of Typical Wooden Ship

sacrificing the top diameter to get young, healthy trees suitable for such use.

Sizes of Timbers and Plankings

The followings table shows the dimensions and quality of the material used for the principal parts of a modern boat.:

Form and Grade	Thickness, Inches	Width, Inches	Length, Feet
Frames-Merch.	11 to 12	14 to 32	10 to 26
Deck Beams—Select	15 to 16	15 to 18	42 to 50
Keels—Select	18 to 20	20 to 24	90 to 120
Keelsons—Select	18 to 20	20 to 22	90 to 140
Planking—Clear	4½ to 7	7 to 16	40 to 90
Decking—Clear V. G.	4 to 6	4 to 6	40 to 60
Ceiling—Select	8 to 14	12 to 16	60 to 80

Probably nowhere else in the world are such thick, wide, long and high-grade pieces of timber available in such large quantities as in the fir lumber producing centers of Oregon and Washington. There are millions of feet of logs in the log markets at all times ready to be cut to any size the naval architect specifies in his plans.

Improvements in Methods of Construction

There is little question but that wooden vessels carefully and conscientiously constructed under the best methods of building prescribed to-day are more substantial than those of years ago. First the bolt and treenail holes are bored with compressed air or electric drills, instead of by hand-operated ship augers. The mechanical drills insure a smooth bore, which increases the holding power of the fastening. The bolts are also driven home and headed with air or electric hammers instead of mauls. This insures more uniform heads and a tighter fastening than was usually obtained by hand. The fact that the machines make the work easier tends to increase the care with which it is done, and in addition there is an enormous saving in labor costs.

Steel reinforcing strips are also used on some of the larger boats. They serve to bind together and strengthen the hull and on the whole greatly minimize the possibility

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of the boat going to pieces immediately in case of shipwreck.

More attention is also paid to the prevention of decay or dry rot around the bolt holes, in the splicing seams and at other points where two surfaces come in contact. The use of common salt as a preservative is rapidly giving place to high-grade creosote and carbolineums. Greater care is also given to ventilation and the prevention of stagnant air pockets, and it is believed that when modern methods of preventing decay as used in other structures, are applied to shipbuilding in a scientific and systematic manner, the underwriters will considerably increase the rated life of the best constructed wooden vessels.

The actual toxic properties of common salt are not well established, and in addition the presence of salt tends to accelerate the corrosion on all the metal fastenings, materially reducing their life and lessening their holding force. It is unquestionable that the liberal application of hot coal-tar creosote or other acceptable substitute to all joints, splicings and other surfaces of contact, as well as in the bolt holes, will greatly retard or even prevent entirely the ravages of wood-destroying fungi.

How the Boats are Assembled

As is well known, the laying of the keel is the first step. While the keel is being laid, the frames are shaped and assembled. Each frame is made double, with lap-joints (see Fig. 2) and of pieces 11 inches to 12 inches thick. They are held together with hardwood pegs or treenails (usually locust or oak) and iron bolts about 1¼ inches in diameter, and are made so secure that the frame really represents one piece 22 inches to 24 inches thick (wide). These frames are set up on the keel on about 32-inch to 34-inch centers and held in upright position and at proper distances apart by "ribbons" fastened along the outside face of the frames. Temporary pieces are also run from the top ends of each frame to retain the proper beam. The keelson and its associated members are then placed on top of the frames directly above the keel. The keel, frames and keelsons are then bolted together securely with galvanized iron bolts. In the meantime the stem and stern post have been put in place and securely fastened to the keel and keelsons. The ceiling and planking are then put on and fastened to the frames by means of both bolts and treenails. Some of the bolts run from the outside of the planking through the frames and ceiling to the interior of the vessel. The deck beams are sprung in place and each is fastened to the side of the ship with large knees. The boat is then ready for the decking rails and cabins. The above described parts represent the principal use of wood in modern shipbuilding.

Size of Wooden Ships

To give the reader some idea of the size of some of the vessels that are being and have been constructed of wood, the following table of dimensions of several wooden boats has been compiled. While quite a number of ships of the larger sizes shown have been built and successfully operated, there is a rather general feeling among naval architect, shipbuilders, underwriters and navigators, that such vessels are not as desirable as smaller ones:

	A	B	C	D
Length	215	285	225	290
Breadth	41.3	48	42.4	48
Depth	16	19	18	26
Date	1896	1916	1902	....
Gross tons	1,014	....	1,237	....
Net tons	902	....	1,105	....
Capacity	1,300M	2,000M	1,500M	2,500M
	E	F	G	H
Length	347	290	252	256
Breadth	50	48	43.4	43.6
Depth	25	....	21.6	21.6
Date	1902	1917	1916	1916
Gross tons	....	2,500	1,450	1,600
Net tons	....	....	1,250	1,300
Capacity	5,500T	2,250M	1,750M	1,900M

Costs of Wooden Vessels

The following figures of the cost of constructing a typical lumber schooner equipped with auxiliary motors, are taken from an article on auxiliary schooners by Martin C. Erismann in the April 1, 1916, issue of the *West Coast Lumberman*. While labor and other costs have increased considerably since last spring, the figures give a general idea of the division, at least, of costs in a modern wooden vessel of fair carrying capacity. The costs of building vessels fluctuate so violently with varying labor and material costs that prospective buyers should not use these figures as an indication of the price a shipbuilder should charge for a boat of given size:

COST OF AUXILIARY LUMBER SCHOONER

Length (custom house)	225 feet 0 inch	
Breadth	42 feet 6 inches	
Depth	18 feet 0 inch	
Gross tonnage (about)	1,250	
Net tonnage (about)	1,125	
Speed, knots, loaded	7	
Lumber capacity (board feet)	1,400,000	
Machinery, two 160-horsepower oil motors	320	
Cost of ship complete (wood construction)	$98,000	(£20,000)
Machinery and installation	24,000	(£4,925)
All auxiliary machinery	10,000	(£2,050)
Design, contracts, supervision, etc.	7,920	(£1,620)
Total cost of vessel	$139,920	(£28,595)

Other Woods for Special Uses

Iron Bark.—Australian iron bark is one of the principal woods used in parts of the ship requiring unusual strength and hardness. This wood is sometimes used for stems, stern posts, rail facings, stem facings, bearing plates, keys and similar parts.

Oak.—Oregon and Eastern oak are used as substitutes for iron bark in many of the above parts. They are also used for treenails.

Locust.—Black locust, obtained from the hardwood regions of the East, is the principal wood for treenails. It is usually purchased in small squares of described lengths and turned to the exact size at the plant.

White Pine.—White pine disks are used to plug the holes in plankings and decks, made by countersinking the bolts and spikes. These plugs are held in place by a coating of white lead. They are put in dry and when moistened with water swell and form a very tight plug.

Amount of Lumber Required Annually

There are now (November, 1916) installed and being installed about 50 to 60 slips at the wooden shipyards in Oregon and Washington capable of turning out from 75 to 90 large wooden vessels annually. Since these vessels will require on the average of 1,250,000 board feet of lumber each, it is very probable that at least 100,000,000 feet of lumber will go into this class of wooden ships annually for the next few years. Its importance to the community is better understood when it is remembered that this will mean the spending of approximately $4,000,000 (£820,000) a year for lumber and about an equal amount for labor by this one industry.

The author is indebted to Mr. Martin C. Erismann, of Seattle, for helpful suggestions in the preparation of this article.

STEAMER TO BE BUILT AT VERA CRUZ.—Manuel Angel Fernandez, of Vera Cruz, Mexico, is to begin building a steamer for cargo and passengers, said to be the largest built in Mexico. It is to have a single deck and is to be 130 feet long, 25 feet wide, and of 10-foot draft. The displacement is to be 200 tons net and 250 tons gross. The propelling machinery is to be an engine of the Diesel type of 200 horsepower.

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WOODEN MOTORSHIP FOR WEST INDIA TRADE

Designed by Young, Rakestraw & Ferguson, Wilmington, Del.

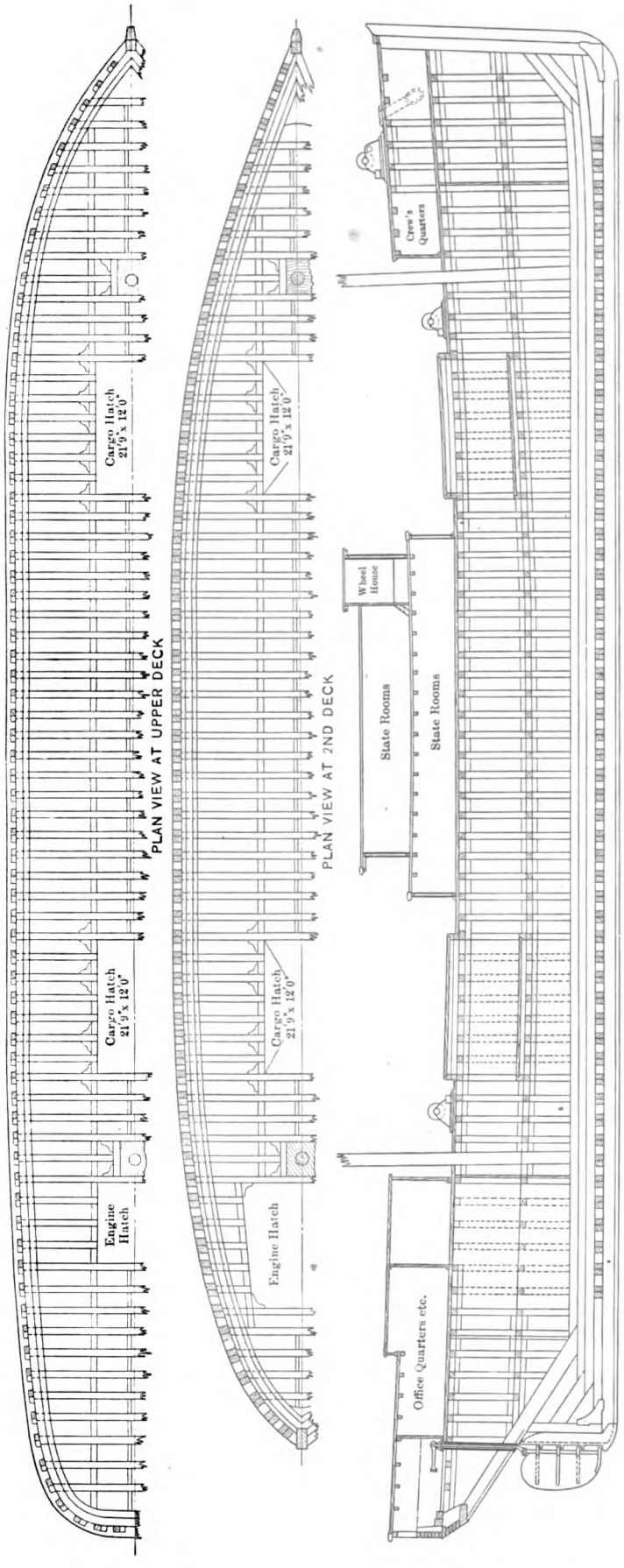

Fig. 1.—Decks Plans and Inboard Profile

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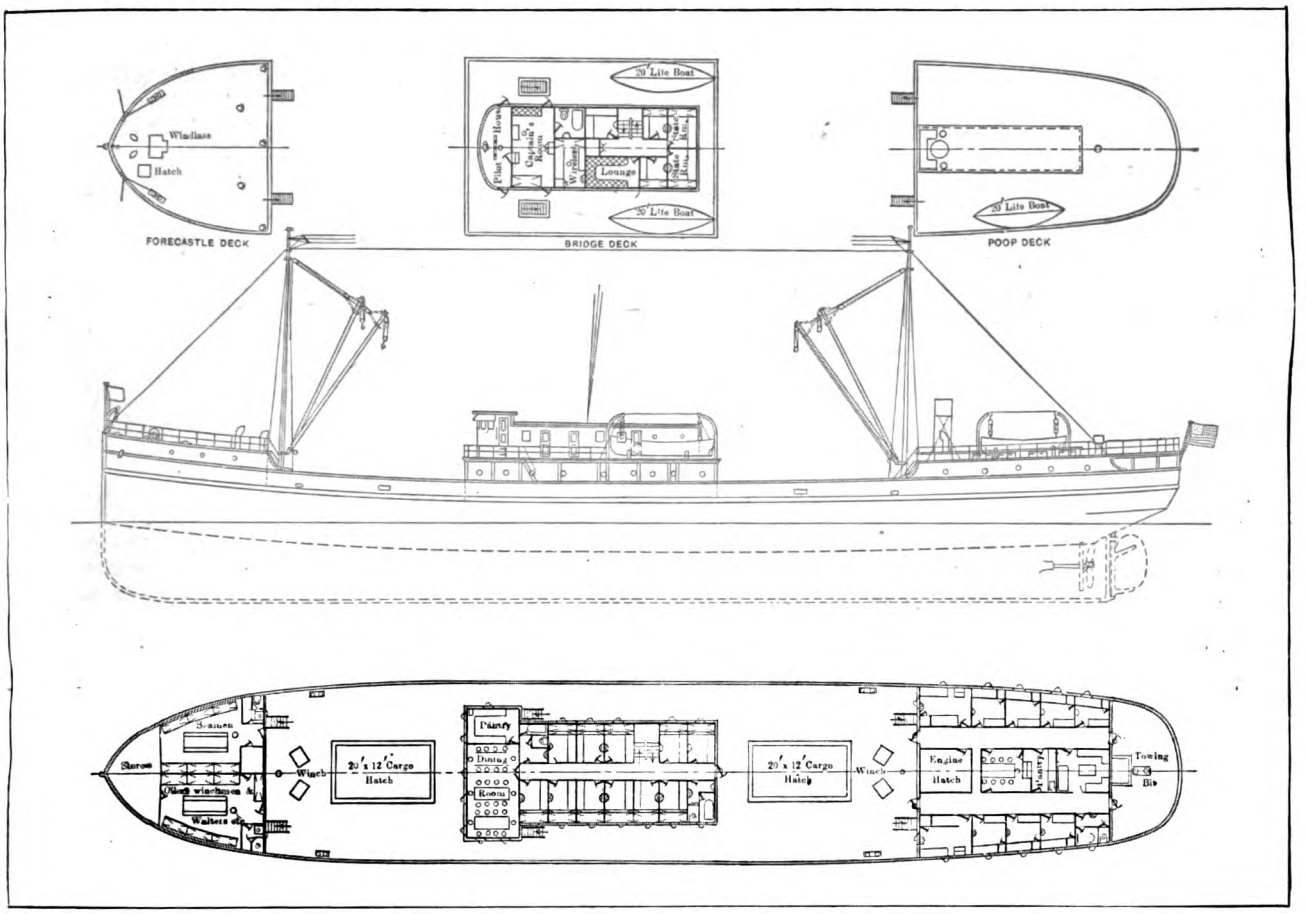

Fig. 2.—General Arrangement Plans

Wooden Motorship for West India Trade

The wooden motorship, shown in the accompanying plans, has been designed by Young, Rakestraw & Ferguson, naval architects, of Wilmington, Del., for the Haiti Trading Company, of New Orleans. The vessel is of the raised forecastle and poop deck type, designed to carry 1,850 tons of lumber and general cargo and about 30 passengers, with fuel and water for a seven-days' round trip to the West Indies. The ship is designed according to the rules of the American Bureau of Shipping and is to be constructed of wood throughout, 1,027,000 board feet of long-leaf yellow pine being required for the purpose

The principal dimensions of the hull are:

Length	235 feet
Breadth, molded	42 feet
Breadth, extreme	43 feet
Depth, molded	23 feet
Draft	18 feet
Deadweight carrying capacity	1,850 tons

Propulsion is by twin screws actuated by Diesel-type engines of 1,250 indicated horsepower. Two fuel tanks of 7,000 gallons capacity and one fresh water tank of 1,500 gallons capacity are fitted in the forepeak under the upper deck and so arranged that when one is empty it may be used as a water ballast tank. A service tank of sufficient capacity for one day's run is located in the engine room, and is connected to the supply tanks in the forepeak by a pipe and pump line. The consumption of fuel oil per horsepower hour is estimated at .5 pound and of lubricating oil in the ratio of 1 gallon to 150 gallons of fuel oil. The grade of oil used in these engines can be obtained at approximately 2½ cents a gallon, depending upon the locality.

The auxiliary machinery consists of donkey boiler and dynamo located on the lower deck aft. There are two steam winches at each mast and large hatches are fitted for the quick handling of the lumber.

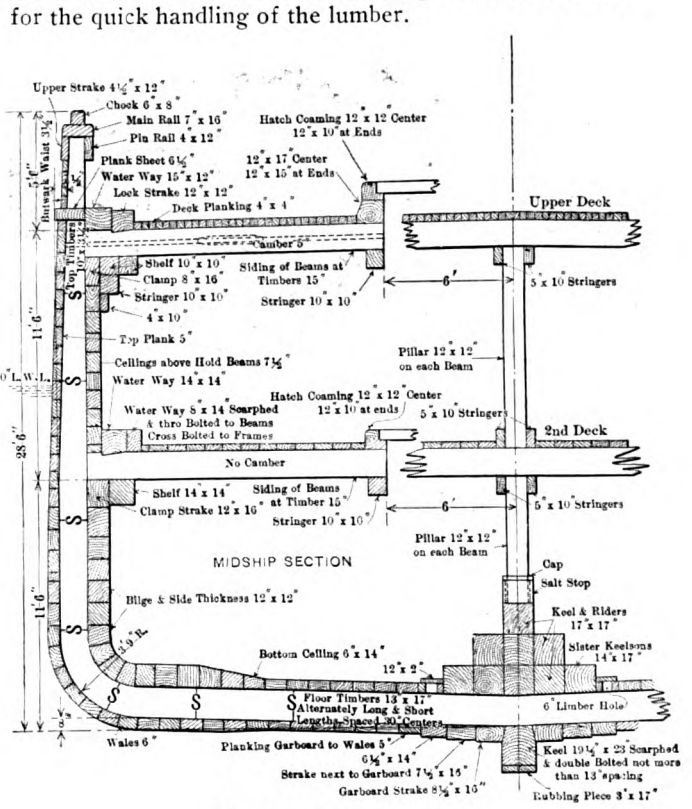
MIDSHIP SECTION
Upper Deck
2nd Deck
Upper Strake 4½" x 12"
Chock 6" x 8"
Main Rail 7" x 16"
Pin Rail 4" x 12"
Plank Sheet 6½"
Water Way 15" x 12"
Lock Strake 12" x 12"
Deck Planking 4" x 4"
Hatch Coaming 12" x 12" Center
12" x 10" at Ends
12" x 17" Center
12" x 15" at Ends
Camber 5"
Shelf 10" x 10"
Clamp 8" x 16"
Stringer 10" x 10"
4" x 10"
Siding of Beams at Timbers 15"
Stringer 10" x 10"
5" x 10" Stringers
Top Plank 5"
Ceilings above Hold Beams 7½"
Water Way 14" x 14"
18'0" L.W.L.
Pillar 12" x 12" on each Beam
Water Way 5" x 14" Scarphed & thro Bolted to Beams Cross Bolted to Frames
Hatch Coaming 12" x 12" Center
12" x 10" at ends
No Camber
Shelf 14" x 14"
Clamp Strake 12" x 16"
Siding of Beams at Timber 15"
Stringer 10" x 10"
Cap
Salt Stop
Bilge & Side Thickness 12" x 12"
Keel & Riders 17" x 17"
Sister Keelsons 14" x 17"
Bottom Ceiling 6" x 14"
12" x 2"
Floor Timbers 13" x 17" Alternately Long & Short Lengths, Space 1'-30" Centers
6" Lumber Hole
Wales 6"
Planking Garboard to Wales 5"
6½" x 14"
Strake next to Garboard 7½" x 15"
Garboard Strake 8½" x 15"
Keel 19¼" x 23" Scarphed & double Bolted not more than 13' spacing
Rubbing Piece 3" x 17"
Batswgk Waist 3½"
5'6"
11'6"
28'6"

Fig. 3.—Midship Section

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When designing the hull the naval architects at first decided to use a steel keelson throughout the length of the vessel in place of the present keelson and sister keelsons. Considerable weight and cargo space could have been saved in this manner, but as it is expected that the vessel will be built in the South all steel work has been eliminated. In place of beam knees, continuous clamps are fitted under each deck.

At the present time it is found that wooden motor vessels are considerably cheaper than similar vessels of steel, and much quicker delivery can be obtained for wooden construction than for steel vessels of similar size.

Wind Resistance of Ships

Results of Tests on Model in Wind Tunnel at Massachusetts Institute of Technology

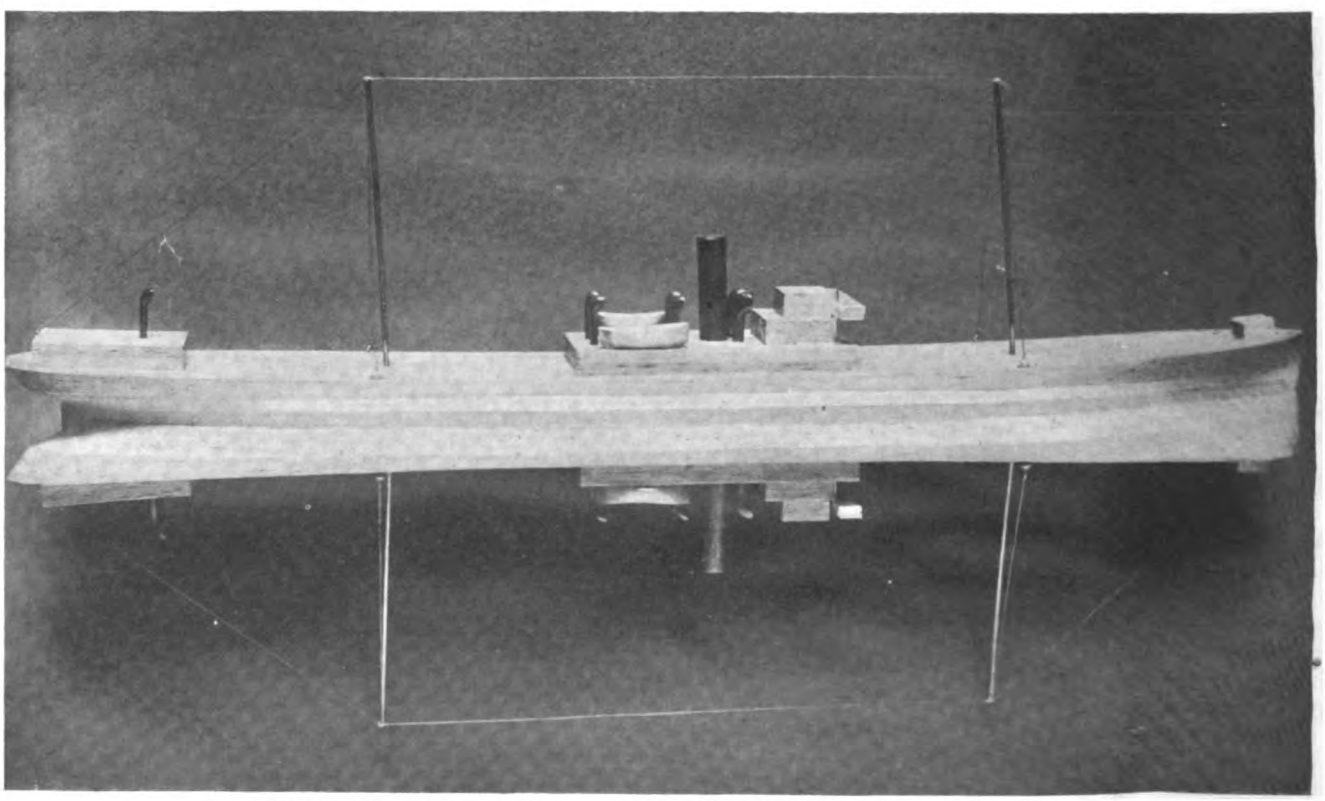
BY SHATSWELL OBER

EXPERIMENTS were made in the wind tunnel of the Massachusetts Institute of Technology, Boston, Mass., to determine the resistance caused by the pressure of the wind on the exposed parts of a merchant vessel. The ship selected was an ordinary cargo steamer, shelter-deck type. Its dimensions were: Length, 360 feet; beam, 46 feet; displacement, 3,270 tons at 23-foot draft. The steamer had a speed of 11 knots and an indicated horsepower of 1,990. The effective horsepower at 11 knots was estimated at 1,200.

The model was made to the scale of 1/16 inch equals 1 foot. This small size (25 inches overall) was necessary to avoid the possibility of interference by the walls of the tunnel and to avoid placing too much weight on the balance. The model was practically complete, except for rigging and minor details. It would not be possible on that scale to use anything that would be similar to the rigging of the ship. The resistance of the rigging, etc., was calculated from aeronautical tables on the resistance of wires, ropes and cylinders. The model was made double; just as if two similar ships were cut across at the waterlines and the above-water parts placed together. Thus the model was symmetrical, both about its centerline and "waterline." The upper works were made detachable, so that the relative resistance of the different parts could be found.

The total wind resistance when the speed of the wind relative to the ship was 26.06 knots (30 miles per hour), was 3,420 pounds. This was divided as follows: Hull alone, 27 percent; lower deck houses, 15 percent; upper works, including pilot house, bridge, stack, boats and ventilators, 31 percent; masts, 8 percent; rigging, etc., 19 percent.

At any speed and for any similar ship the resistance may be calculated by the formula $R = 0.0036\ A\ V^2$, in which R is the resistance in pounds, A the total projected area in square feet of all parts above water and V the speed of the air relative to the ship in knots. It is of in-



Double Model of Cargo Steamer Used to Determine Wind Resistance of Exposed Parts of Vessel

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terest that, if a similar formula is formed for the hull alone, the constant instead of 0.0036 is only 0.0019. From his experiments with the *Greyhound* (Proceedings of the Institution of Naval Architects, Vol. XV) William Froude reports a similar formula, but gives for the constant 0.0048.

Of the total effective horsepower, 1.7 percent is used in calm air in overcoming wind resistance. This percent increases rapidly, if the ship runs into a wind. If the wind were dead ahead and 30 miles per hour absolute, 215 horsepower would be absorbed, or about 18 percent of the total. If the effective horsepower were constant and there were no increase in water resistance due to waves, there would be a loss of speed of somewhat over half a knot, or 5 percent. Actually, this loss would be greater.

Naval Constructor William McEntee reports (Transactions, Society of Naval Architects and Marine Engineers, 1916) the wind resistance of the United States collier *Neptune,* found by wind tunnel resistance on an exhibition model. He states that against a wind of 30 miles absolute the power absorbed would be about 20 percent of the total effective horsepower. A statement of the percent of power taken by the wind or the percent the wind resistance is of the total gives no basis for comparison or application to another ship; for such a statement makes the wind resistance depend on the size and shape of the under-water body of the ship. It does, however, give a general idea of the magnitude of the wind resistance.

Why Is Camber?

Old Mac, the Veteran Ship Draftsman, Shows "the Cubs" How to Lay Down the Camber of Deck Beams

CHARLEY ADAMS had been working for a week arranging gratings, etc., in the engine and boiler room. He had been after Old Mac several times to know the height of the coamings and different points on the beams. Mac would scale these points for him off the body plan. The last time he told Mac that he was a quarter of an inch higher on the same point than before. Mac gave him a hard look and asked him why he had put him to that trouble the second time. Charley said that he wanted to check him up and see how closely he was working.

Charley is no respecter of persons. To him everybody is alike. He had come into the office from the shop, where he had the reputation of being decidedly fresh. The story goes that on several occasions he had been roughly handled by some of the older men who would not put up with his disrespect. Mac looked him over again and quietly said that after this he could do his own scaling, and then if there was any variation he could have himself to blame.

Mac left him looking foolishly at the body plan. Charley monkeyed around for awhile and then quietly slipped over to his board. Some time later he told the chief that the hull side would not help him out and he guessed he was hung up with his job.

The chief asked Mac what the trouble was. Mac smiled and said that Charley was so particular that he had better wait until the beam mold and offsets came in from the loft and then he could get coaming heights as close as he wanted them.

"How close does he want them?" asked the chief.

"Well, he seemed to think that a quarter of an inch variation scaling that half-inch body plan was pretty coarse," said Mac.

"Huh!" exclaimed the chief, "he will be figuring press fits on the treads of those ladders next. Say, Mac, you had better add this one to your other two cubs and give the three of them a talk on camber. Getting these kids started right will save time in the end and may help us to put through that camber scheme of ours some day. Old Jerry certainly does ball us up and delays us every time he puts that mysterious camber of his into the ships he lays down in the loft. He will never use a slide rule, Mac; that is a sure thing. Round them up this afternoon some time."

"All right," said Mac, resignedly.

As the chief went to his desk he stopped at Charley's board and told him that Old Mac was going to give young Stevens and Tek a talk on camber after lunch and that he wanted him to get in on it. "Don't you be fresh again with Mac," warned the chief. "He is a good fellow and will be a good friend of yours, if you treat him right. Cut out this rough talk. If you persist in it, you will finish your time out in the blacksmith shop and that blonde girl of yours will give you the go by and walk home from church on Sundays with that tall thin fellow who works in the bank. What do you say?"

"I got you the first time, chief," replied Charley. "I am hip."

When Mac came in from the yard at noon the three cubs were on hand. Charley had posted the other two. Mac started in without ceremony, as follows:

"Camber is the curvature given a deck beam so that the deck is high at the center and slopes down at the sides of the ship. The idea is that the deck will shed water and drain to the sides. This may be of importance in the case of wooden and weather decks. A wooden deck rots if it does not drain properly. The classification societies require a round up or camber of a quarter of an inch per foot of beam. A steel deck does not rot and the ship is not always plum, so that camber here does not seem necessary.

"The idea that a cambered beam is stronger than a straight or level beam is wrong. Cambering does not increase the section modulus. A cambered beam is not an arch, because the sides of the ship are not abutments that will successfully resist a thrust. The stress line would lie away off the middle third, if there were not more curvature than camber gives. The Lord only knows what the load would be.

"The use of camber is often a waste of effort. Many decks would be better flat. The wooden shipbuilders handed this camber idea down to us and it may be some time before we can get rid of it. It is a nuisance. This wooden shipbuilder would lay it down secretly on the loft and contend that, due to the particular round up of beam and the shear that he used, his ship would sail faster

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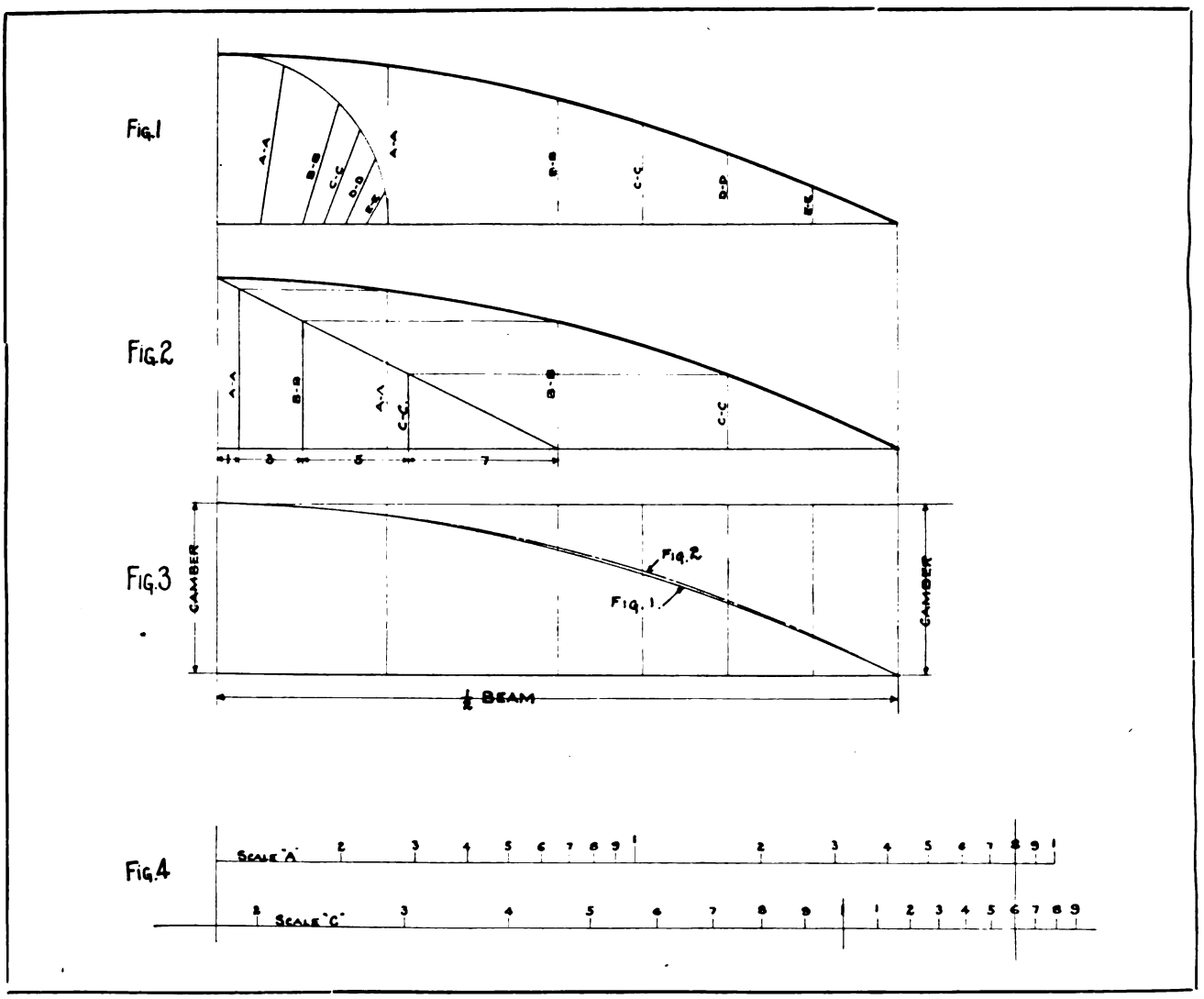
and closer to the wind than any ship yet built. She would be stronger and more stable—until he built the next one, then he had to improve the camber. Camber is with us though and you will have to know how to handle it, so I will tell you how it is laid down.

"One way is to draw a circle and divide the base and one quadrant like this (see Fig. 1). Connect the corresponding points. Set off these heights on corresponding points, using the half beam of the ship as base line, thus (see Fig. 1). A curve through these points will give the desired shape of the cambered beam. As the beam shortens as the ship narrows in, the lower or outboard end is cut off so the middle portion remains the same. *A-A, B-B* and *D-D* are the quarter points and *C-C* and *E-E* are just put in on the eighths to give more points and better define the curve. Do you understand this, Charley?"

"Yep, I get you," replied Charley.

"Another way," continued Mac, "is to set up at the quarter points of half the beam of the ship 1/16, 4 16 and 9/16 of the camber at the center. This is called the 1-3-5-7 rule, because an easy way to get these fractions of the camber is to lay down a base line of sixteen units in length, erect the camber at one end and join this point with the end of the base line (see Fig. 2). Perpendiculars erected at the one, three and five points will give the one, four and nine-sixteenths desired. A curve through these points gives another beam camber and probably the one most used.

"Now you see that if I lift the first curve and put the tracing cloth over the second one there is not much difference. The 1-3-5-7 curve is a little sharper and fuller, but not much (see Fig. 3). The flatter curve might be an advantage in a boat that has a lot of hatches at the center and whose deck beams are short and nearly flat at the side. Surely this small difference would not set the world afire, but there are some fellows who will want to fight if you don't favor their particular camber.



Methods of Laying Down the Camber

"Some people think there is another camber. Your slide rule friends swear by it, Tek, and if a slide rule is good for anything at all, maybe this is it. However, the slide rule camber is a parabola and the same parabola that the 1-3-5-7 rule gives. The apparent difference is that the ordinates of the 1-3-5-7 rule are laid up from the base line and the slide rule readings are laid off down from a base line (see Fig. 3).

"Now to work this slide rule camber you pick the camber in inches out on the upper or *A* scale of the rule. As all of your readings will be to the left you had better keep as far to the right as possible. Say, for example, the half beam is 16 feet. At a quarter of an inch per foot the camber would be eight inches. Well, let us take the eight near the end of the *A* scale (see Fig. 4). Set the

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runner here. Now bring the sixteen on the *C* scale under the runner and you are set. For any other half breadth the camber can be read directly off the *A* scale. Of course when you pass the one or ten of the *C* scale, which is the ten-foot half breadth in this case, you have to shift the slide to the left so that half breadths less than ten come on the rule (see Fig. 4).

"Let us figure these fractions and lay them down from the top on to the 1-3-5-7 curve. Take the eight-foot outpoint, for instance. It is 2 inches even. The 1-3-5-7 rule gave us 6 inches even, remember? Two inches plus 6 inches is 8 inches, the total camber. Do you get me, Adams?"

"I got you," said Adams promptly.

"Now, the beauty of this slide rule camber method is that no graphical solution has to be depended upon. One man may lay down the camber graphically a little bit differently from another. With the graphical method one man has to lay it down and the rest of us have to use his work, and when we want a point on some odd half breadth we have to get him to scale it off for us. The personal element comes in here and makes a lot of trouble, especially when that person is a wild Irishman, whom you can't reach with a 10-foot pole. Jerry is certainly perpetuating the one-man rule in the loft. You see, if we could prevail on Old Jerry to use this slide rule method, then we could get the beam height at any point and at any time, because all slide rules are the same and Jerry could not help but lay down his beam mold as we would figure he would. We would not have to go near him. He don't know how to use a slide rule, won't learn and the higher-ups don't believe in experimenting during these rush times, so the slide rule method, although it is a good one, will have to wait until we can get around Jerry, or until some other yard makes an owner pay for this pioneering. The higher-ups say that it will cost us something to get it going right, and just as soon as we get to bragging pretty strong about it, all the other yards will adopt it, the price of ships will go down and then we will have had all our trouble for nothing.

"That gives me an idea. 'Old Man of the Sea' may be able to handle Old Jerry. They are cut out of the same cloth. 'Old Man of the Sea' would jump at the chance of teaching the game something new, and I think that it would be a good way to get him out of the office. Sick him onto Old Jerry, as it were, and let them go to it. Greek would meet Greek and we would win no matter how the cat jumped. Beat it, kids; here comes 'Old Man of the Sea.' Say, Adams, when you try that slide rule business the first time, be sure that you are not ten or a hundred feet off. Better get Tek to check you up."

"I am hip; I got you," replied Adams.

Later in the day Tek dug up his school books and looked up the equation for a parabola. $Y = a x^2$. In the case of the camber, curve Y is the ordinate down from the base and x is the distance out from the center of the ship. When x is equal to the half beam, Y is equal to the total camber, so that C = camber $= a \times l^2$ where l is the half beam of the ship. Therefore,

$$Y = \frac{C}{l^2} \times x^2.$$

For x equal to ¼, ½ and ¾ of the half beam Y would be equal to 1/16, 4/16 and 9/16 of C, or just what the 1-3-5-7 rule gives. Mac was right. Tek was satisfied.

Annual Meeting of the Institution of Naval Architects

The annual meeting of the Institution of Naval Architects was held in the hall of the Royal Society of Arts, John street, Adelphia, London, on March 28 and 29. Sessions were held in the morning, afternoon and evening of the 28th and in the morning and afternoon of the 29th. The programme was as follows:

WEDNESDAY, MARCH 28

1. Standardization as Applied to the Machinery for Cargo Boats. By D. B. Morison, member of Council.
2. On a Method of Obtaining for Ship Design the Spacing of Bulkheads According to the Rules of the International Convention. By W. J. Lovett, member.
3. Stress Determination in a Flat Plate. By James Montgomerie, B. Sc., member.
4. The Closing of All Ship Side Apertures from the Bridge. By Signor E. Benvenuti, member.
5. Description of an Apparatus for Interpreting Stability for the Use of Shipmasters. By Thomas Graham, associate member.
6. The Strength and Inner Structure of Mild Steel. By Professor W. E. Dalby, M. A., B. Sc., F. R. S., associate member of Council.
7. Design of Pin Joints Based on Ultimate Strength. By Lieut. W. A. Scoble, R. N. V. R.

THURSDAY, MARCH 29

8. Further Experiments Upon Wake and Thrust Deduction Problems. By W. J. Luke, member of Council.
9. Some Experiments on the Influence of Running Balance of Propellers on the Vibration of Ships. By J. J. King-Salter, R. C. N. C.
10. Theory of Wave Motion on Water. By Sir George Greenhill, M. A., F. R. S.
11. Marine Application of Reduction Gears of Floating Frame Type. By J. H. Macalpine, member.
12. On Launching. By P. A. Hillhouse, B. Sc., member of Council, and W. H. Riddlesworth, M. Sc., M. Eng.
13. Buoyancy and Stability of Submarines. By Professor W. Hovgaard, member.

New Concrete Shipways at Fore River Shipyard to Accommodate the Latest Type of Battle Cruisers

Following closely upon the heels of the announcement that the Fore River Shipbuilding Corporation, Quincy, Mass., had been awarded the contract to build one of the United States battle cruisers comes the decision to construct an entirely new set of ways to handle this great war vessel. Over $500,000 (£102,500) will be spent for the work.

To facilitate the erection of the ways the Massachusetts State officials condemned the necessary land, and the contractors, the Alberthaw Construction Company, Boston, Mass., have begun the surveying and soundings.

The new ways will be as large or larger than any in the world. They will be 990 feet long and will be fitted with electric cranes and overhead steel work embodying the most modern ideas for building vessels of all types. Even when one of the battle cruisers, which are the largest in the world, is lying on this set of ways, there will be 125 feet to spare in length, which may be taken to mean that the yard is preparing for a future growth in warships.

The heavy foundations supporting crib for keel blocks and launching ways are all to be of concrete. Over 12,000 cubic yards of concrete and 3,000 wooden piles will be required and approximately 3,000 tons of structural steel will be used in erecting the crane ways. These will be 870 feet long and will carry one 50-ton and three 75-ton cranes, all of 120-feet span. The larger crane will run 121 feet above mean low water.

There has been little delay in getting to work and while the ways are being built the shop work on the cruiser will go ahead rapidly. The Alberthaw Construction Company plans to complete the ways, ready for the laying of the keel by September 1.

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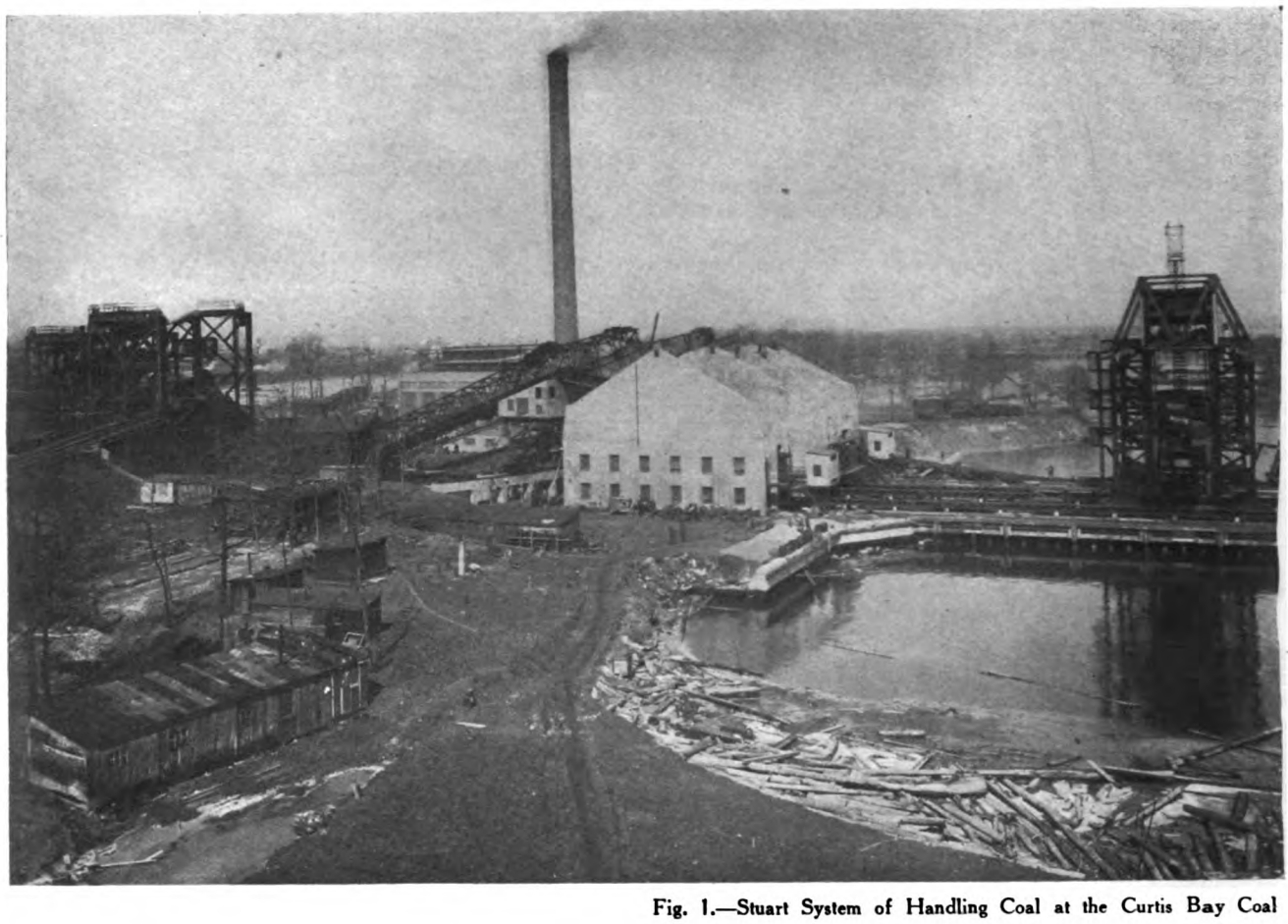

Fig. 1.—Stuart System of Handling Coal at the Curtis Bay Coal

New Baltimore & Ohio Coaling Pier

Maximum Capacity of New Coaling Pier at Curtis Bay Terminal 7,000 Tons per Hour—Two Units Installed on Single Pier

THE new $2,500,000 (£512,500) coal pier of the Baltimore & Ohio Railroad Company, which is now being operated at its Curtis Bay terminal, Baltimore, Md., is the first one of its type ever built, and once more that company becomes the pioneer in this important branch of freight transportation.

In 1914 the present facilities of the company had reached their maximum capacity, and the management decided to build a new coal pier. Before deciding on a type, however, the coal piers along the seaboard and abroad were considered, so that proposed new facilities would compare favorably with the best in existence, and while considering various schemes the engineering department originated one to handle coal by mechanical means.

The entire improvement was originated and designed complete by and under the direction of Mr. F. L. Stuart while he was chief engineer of the company, patents having been issued to him covering the main features of the same. Upon the resignation of Mr. Stuart from the Baltimore & Ohio last July the work was taken up and completed under the direction of his successor, Mr. R. N. Begien, the present chief of the company, and associated with him were W. S. Bouton, engineer of bridges; J. H. Davis, electrical engineer; M. A. Long, architect and assistant engineer; F. C. Thornley, consulting engineer, and J. T. Wilson, district engineer.

The contractors on the improvement were H. S. Kerbaugh, dredging; Phenix Construction Company, pier substructure; Smith & McCormack Company, excavation and foundations; Edward Brady & Sons, reinforced concrete bins; McMyler Interstate Bridge Company, car dumpers and tower structures; Robins Conveying Belt Company, conveying machinery; General Electric Company, control, motors and wiring; Westinghouse Electric & Manufacturing Company, sub-station, and Surety Engineering Company, coal thawing shed.

The Scheme in Detail

This scheme consists of two car dumpers and a concrete pier with its deck 8 feet above mean tide. On this pier are four loading towers and two trimming towers, to which the coal is delivered by belt conveyors from receiving hoppers at the car dumpers or from the balancing *bin* interposed between the dumpers and the pier. The installation consists of two units—one car dumper, two loading towers and one trimming tower making a unit.

Each car dumper is designed to handle sixty cars of 50 tons capacity each per hour, or forty cars of 100 tons capacity each per hour, and will handle a car 54 feet in length.

The tracks leading to the dumpers are on a descending grade, so that cars run to the barney pit by gravity. The

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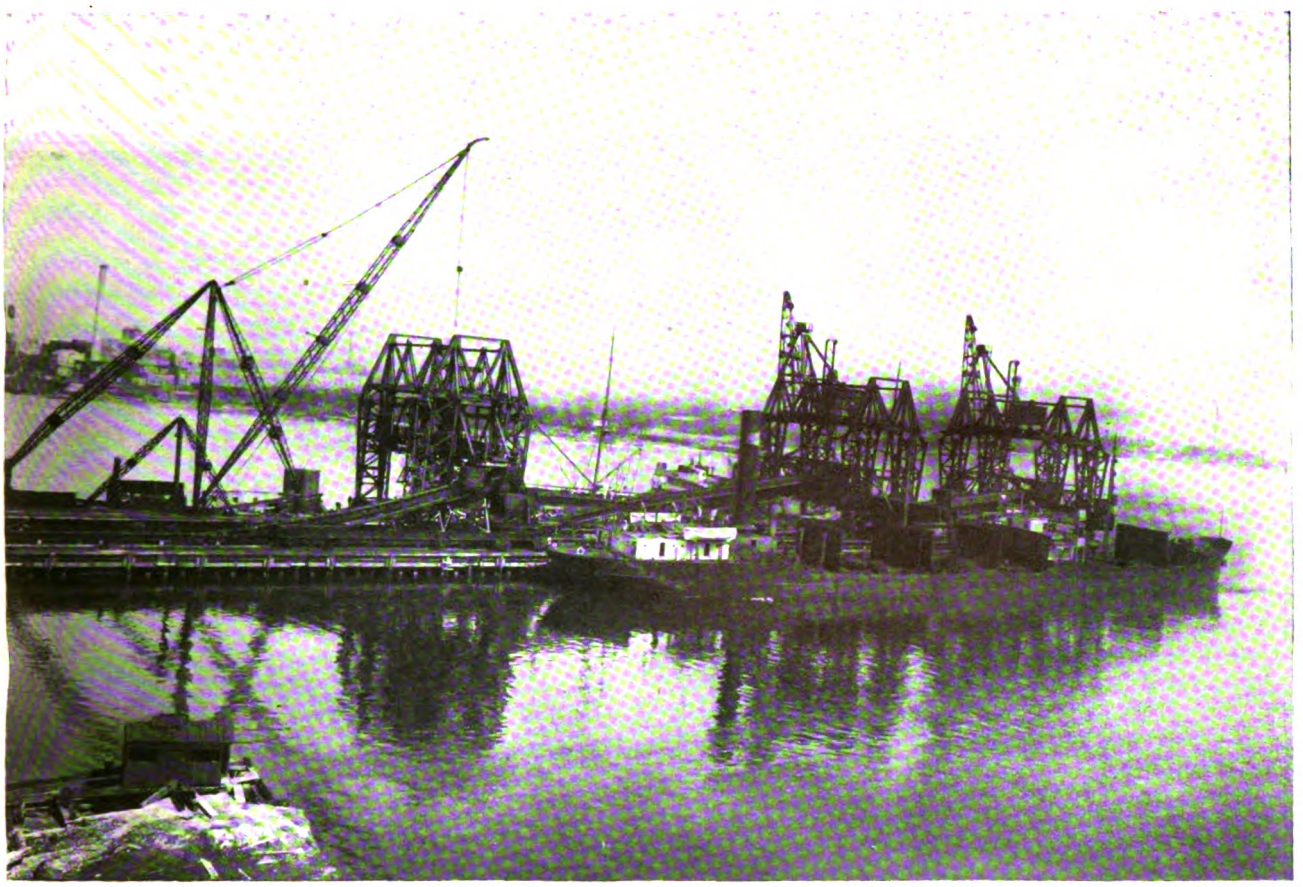

Pier of the Baltimore & Ohio Railroad Company, Baltimore, Md.

barney pushes the car up a 10 percent grade to the cradle of the car dumper. After the car is placed on the cradle it is clamped and turned upside down, delivering the coal onto a counter-weighted apron. This apron or pan can be raised when a car is to be dumped so as to minimize the drop of the coal from the car. When the car has been dumped the apron is lowered to an angle that permits the coal to slide freely from the apron to the belts that convey the coal to the vessel.

There are three belts to each car dumper, each belt being 60 inches in width, having a capacity of 2,000 tons per hour, running 500 feet per minute. Two in each group run out on the pier to a loading tower. The third runs to the balancing bin.

In order to run the plant to its maximum capacity the operation of the car dumpers must not be interfered with, and when it is necessary to stop a loading tower to shift it to another hatch the coal is placed in the balancing bin temporarily. From this bin the coal is taken by either a loading tower or trimming tower and placed into the vessel.

The Loading Towers

The loading towers are each equipped with a cage supporting a shuttle ram. The cage is raised and lowered to suit the height of the vessel being loaded. It has a variation in height of 27 feet, the minimum height above the water being 15 feet. The shuttle ram can be run out on either side of the pier; its maximum reach from the face of the pier being 45 feet.

As the towers travel up and down the pier in a horizontal plane and the shuttle works in and out at right angles to the travel of the towers, it can readily be seen that this apparatus will load a hatch uniformly and reduce trimming to a minimum.

The two trimming towers (one on each side of the pier) have belts 48 inches in width, with a capacity of 1,500 tons per hour, running 500 feet per minute. Coal for these belts is taken from the balancing bins. These towers have swinging booms 45 feet long. They are attached at their base to turntables and can be moved in a circle on a horizontal plane and have a vertical variation of 35 degrees each way from the horizontal.

While the loading towers are working on the cargo the trimming towers are loading the bunker coal. After the loading towers have finished loading the cargo (except the trimming) the trimming tower finishes the slow work on the vessel, the loading towers being free to work on another vessel.

The various functions are interlocked and controlled electrically with push-buttons located every 20 feet on each belt conveyor runway. By pushing a button all movable parts of the belts, tower and feeders are stopped.

The operators are located in houses on the shuttles. From their houses they start first the shuttle belt; when this is running at full speed the main belt automatically starts, and when at full speed the feeders start automatically. The shuttle belt runs at a greater speed than the main belt, and the main belt runs faster than the feeders, so that there is no danger of flooding the main or shuttle belts. There is a master control in the superintendent's office, so that he can establish the maximum speed at which the belts can be run.

The Pier Capacity

The pier will not only have the greatest capacity of any pier in existence, but will handle coal with a minimum amount of breakage. On the loading towers a lowerator will be attached when gas (lump) coal is being handled.

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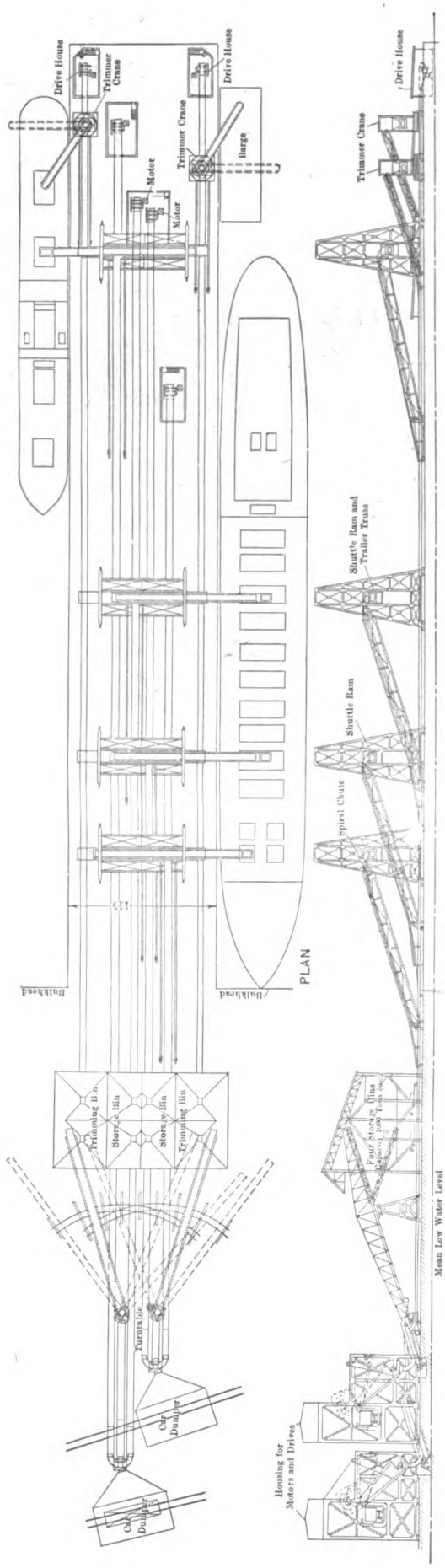

Fig. 2.—General Arrangement of Stuart System of Handling Coal at New Baltimore & Ohio Coaling Pier

The lowerator carries the coal into the vessel and deposits it with a maximum drop of about 3 feet.

The pier is of reinforced concrete dock and girders supported on concrete piles. The mechanism on the pier is all of steel construction, so that the entire pier is built of fireproof material. The old facilities are entirely of wood construction.

Two tracks leading to the car dumpers are covered by a steel and concrete thawing shed of 22 cars capacity, into which cars are placed for thawing in severe winter weather. Experience shows that cars placed in this house

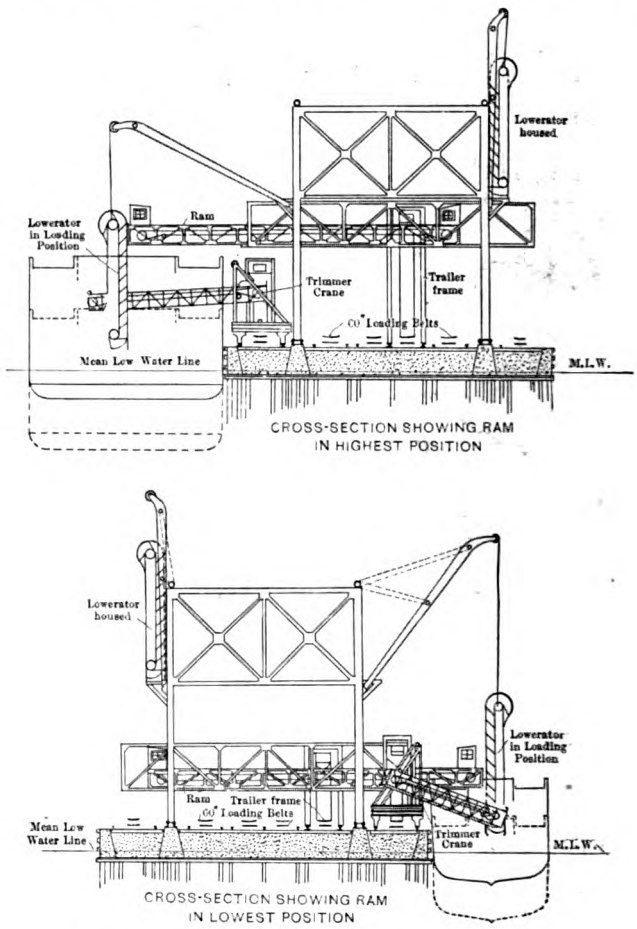

Fig. 3.—Sections of Pier Showing Operation of Ram

for thirty minutes, at a temperature of 180 degrees, are thawed sufficiently for the coal to free itself.

All functions are operated by electric power, except the car dumpers and the thawing shed. These are operated by steam.

It was necessary to dredge a channel into the new pier, as well as the slip on each side. Four hundred and fifty thousand yards of sand and clay were dredged and used to build the yard. This was done by suction dredge and pumped to a maximum height of 30 feet.

ADVANTAGES OF SYSTEM

The pier has many advantages: (1) It will have a greater capacity than any other in existence; (2) it will handle lump coal with a minimum amount of breakage; (3) it is fireproof; (4) it will permit of the unloading of any type of open car with ease and dispatch; (5) it will be the means of attracting a great deal of business to the port of Baltimore; (6) it will improve the coal car supply.

Actual work was commenced in February, 1916. The first half of the pier was put into service January 15, 1917.

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Considering the magnitude of the work, the amount of special machinery necessary and the condition of the material market, the record for speed was remarkable.

Capacities of the Old and New Piers

The maximum capacity of old piers was 2,500 tons per hour when loading into the type of boats similar to those owned by the Federal Coal Company. The average working capacity of old piers was 1,250 tons per hour.

The maximum capacity of the new piers is 7,000 tons per hour, with both dumpers working (2,500 tons per hour per dumper, with trimmers handling 1,000 tons per hour each from the balancing bins). The average working capacity of new pier is 4,000 tons per hour.

The speed of delivery of coal from barney to hold of vessel is 8 cars in 21 minutes, or 2.6 minutes per car by test (one belt working); 16 cars in 21 minutes, or 1.25 minutes per car by test (two belts working). In recent operations a car has been dumped in a minute.

One car dumper will feed two belts. It is expected to dump 45 cars per hour per dumper, or 90 cars per hour, or 5,000 tons per hour. Two thousand additional tons per hour will be handled by the trimmers from the bins, making ultimate capacity 7,000 tons per hour.

The Terminal Shed and Warehouse—II*

BY H. MC L. HARDING†

Wooden sheds and wooden piles substructures above the water's level, which may be swept away by fire, both shed and substructure, in an hour, along the whole terminal frontage, and leave only the blackened tops of the piles just above the water, thereby stopping all waterborne commerce for months, should not be permitted, any more than wooden buildings within the fire limits of a large city.

The three characteristics of substructures should be fireproof, rat proof and decay resisting.

The following figures as to the initial investment, based on cubic contents of the modern steel sheds, on quays, with 30 feet inside clearance, 500 feet long and 80 feet wide, in comparison to the usual type of wooden shed with 15 feet clearance, may reveal facts and truths not generally accepted.

It is desired to hold in the shed about 800,000 cubic feet of merchandise. As has been shown, this can be stored in a steel shed 500 feet long, 80 feet wide, and tiering 20 feet high by overhead traveling cranes with adjustable loops. At 3½ cents per cubic foot, the investment for this steel would be $42,000 (£8,600), and the gross floor space would be 500 feet by 80 feet, or 40,000 square feet. The investment per cubic foot for a wooden shed would average $0.0246. This is where lumber is exceedingly cheap.

Tiering 5 feet high instead of 20 feet, the floor area would be 160,000 square feet and the cubic contents 3,200,000 cubic feet, and the investment $78,720 (£16,120). This is for a wooden shed against $42,000 (£8,600) for a steel shed of equal capacity. That is, to store 800,000 cubic feet of freight, there would be in the wooden shed 160,000 square feet of floor space and of roof, against 40,000 square feet with the steel construction. The wooden shed would not be satisfactory for the internal assorting, distributing and tiering machinery. If these three necessary movements are performed by manual labor, the operating costs would be tripled. Floor space should not be reserved for mechanical appliances when overhead unoccupied space can be used.

In addition to the above, the cost of the land for the shed alone would be four times as much, and at $15,000 (£3,075) only per acre the cost for the additional land would be $45,000 (£9,225) more, than where the steel shed is adopted.

The above figures are comparative only, but prove conclusively that it is more economical even where lumber is cheapest and steel the highest, to construct at a modern terminal the shed of steel rather than of wood, where large tonnages are to be handled. The capacity of modern freighters is continually being increased and 1,000,000 or more cubic feet would more than likely be required than 800,000 cubic feet.

The principle of not having railway tracks within the shed, but outside, is of great import. Two or four railway tracks within the shed would occupy so much cubic foot space, that to have the same holding capacity as 800,000 cubic feet would add greatly to the cost of the shed, whether of steel or wooden construction.

In certain steel sheds lately constructed there were sixteen or more railroad tracks within these freight sheds. It is estimated that the cubic space reserved for the cars on these tracks added at least $80,000 (£16,400) to the cost of the sheds.

These and other examples are not given for criticism, but to make evident the need of terminal principles.

The following figures as to wooden shed costs are given as guides of low costs of wooden sheds and the costs of some of the accessories. The cost of the building includes that of the roof etc. When on a pier or wooden structure the floor cost is charged to the substructure. The average increase at date should be about 10 percent. These figures are from Seattle, Wash.

Example 1.—Two-story shed, 20 feet by 800 feet:

Superstructure	Cubic Foot Contents
a. Building	$0.0366
b. Office and toilets	0.0014
c. Water supply	0.0008
d. Sprinkler system	0.0054
e. Electric wiring	0.0027
f. Paving	0.0010
g. Elevator	0.0062
h. Roofing	0.0009
Per cubic foot	$0.0550

Example 2.—One-story wooden shed, 90 feet by 330 feet:

Superstructure	Cubic Foot Contents
a. Building	$0.0185
b. Offices and toilet	0.0005
c. Water supply	0.0005
d. Sprinkler system	0.0036
e. Electric lights	0.0000
f. Roofing	0.0010
Per cubic foot	$0.0250

Example 3.—One and two stories, mostly one story, the gross area being 166,200 square feet:

Superstructure	Cubic Foot Contents
a. Building	$0.0232
b. Office and toilets	0.0006
c. Sprinkler system and water supply	0.0043
d. Electric lights and wiring	0.0011
e. Paving	0.0005
f. Roofing	0.0000
Per cubic foot	$0.0306

* Concluded from the April issue.

† Designing Terminal Engineer, New York, N. Y.

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Example 4.—One story, two buildings. Two U-shaped buildings, each arm of the U being 600 feet in length and about 97 feet in width:

Superstructure	Cubic Foot Contents
a. Building	0.0170
b. Offices and toilets	0.0005
c. Water supply	0.0008
d. Sprinkler system	0.0020
e. Electric lights	0.0007
f. Roofing	0.0010
Per cubic foot	$0.0220

Warehouse Costs

The cost of the concrete warehouse will also vary according to location, building laws and other conditions. In general, the cost of the building of four or six stories for miscellaneous goods will vary between 11 and 12 cents per cubic foot. Ten cents was a safe outside figure for a six-story terminal warehouse building three years ago.

In a concrete warehouse of three floors the following figures may be of service:

Item	Cost Per Cubic Foot
Concrete building	$0.1133
Elevators	0.0109
Electric light and power, wires and fixtures	0.0026
Plumbing and heating	0.0009
Sprinkler system	0.0057
Mastic roofing	0.0024
Per cubic foot	$0.1358

In this particular concrete warehouse for three floors the cost per square foot of gross storage is $2.343. The cost per ton storage, net, $9.716.

The cold storage portion of a warehouse, three stories, was per cubic foot:

Item	Cost Per Cubic Foot
Building	$0.1053
Elevators	0.0141
Plumbing, etc.	0.0023
Sprinkler system	0.0068
Electric light and power	0.0133
Mastic floor and roof	0.0131
Refrigerating equipment	0.0632
Insulation	0.0480
Well, pit	0.0105
Per cubic foot	$0.2766
Office, one floor, per cubic foot	$0.2488

Another concrete warehouse with electric light and power, sprinkler system, elevated tank, roofing, freight elevators, chutes, conveyor, scales, was $0.1069 per cubic foot.

Fruit Storage Warehouse

The cost per cubic foot of a fruit storage warehouse without refrigeration equipment was $0.1081 per cubic foot.

The Grain Elevator—Data and Costs

A grain elevator is practically a grain storage warehouse with the necessary machinery for unloading cars or vessels into this warehouse, elevating the grain and discharging it into ships, barges, cars or drays. There are also included other mechanical appliances for separating, cleaning, sacking and weighing the grain. The following data and costs of an elevator of a capacity of 500,000 bushels are of value.

The building is of reinforced concrete and consists of 25 circular bins of 15,000 bushels each, 16 interspace bins of 3,600 bushels each, and 25 workhouse bins. Height of storage annex, 83 feet. Height of workhouse, 165 feet. Bulk receiving capacity per day of twenty-four hours, 95 cars. Bulk shipping capacity per hour, 20,000 bushels.

Machinery of modern type driven by electricity.

The principal equipment consists of the following:

Three separators, or cleaners, capacity, each, 3,500 bushels per hour.

Two smutters, capacity, each, 500 bushels per hour.

Two receiving scales.

Two sacking scales.

Two shipping scales.

Two sack grain conveyors.

Two receiving legs, capacity, 6,000 bushels per hour, each.

Two shipping legs, 10,000 bushels per hour, each.

The cost of the elevator is, roundly, as follows:

Foundation	$26,500
Elevator contract	197,900
Cement	15,000
Bulk shipping conveyors	30,000
Miscellaneous other equipment	7,000
Tracks	9,000
	$285,400

The elevator is operated directly by the Port Commission under the State Terminal Warehouse law, which requires State supervision, weighing, grading and registered warehouse receipts. The owner controls the grain absolutely until sold by him. The port has no other interest than to provide the facility and the best possible service at practically actual cost.

Conclusions

1. The water frontage should be used only for those functions which pertain to quick transference of freight and cargo between vessel and shore.
2. Warehouses should be set back from the water frontage.
3. Sheds should be of steel and warehouses of reinforced concrete.
4. Sheds parallel to the berthing frontage should be set back from the water's edge about forty feet.
5. Tracks should be in front of the shed between the shed and the edge of the pier and behind the shed between the shed and the warehouse.
6. The top of the rails should be flush with the pavement.
7. The warehouse should be parallel to the shed and of the same height.
8. Tracks should be spanned by gantry cranes.
9. Assorting, distributing and tiering within the sheds should be done by overhead traveling adjustable loop cranes which operate in unoccupied air spaces.

New Office of Marine Engineering in London

In order to be prepared to handle our business to the best advantage when peace is restored, and to do all we can to further the best interests of our allies, the London office of Marine Engineering has been greatly expanded. Mr. E. J. P. Benn, Director of the English edition, has made preparations to meet any contingency. The capital of Messrs. Benn Bros, Ltd., has been increased to $487,000 (£100,000). The enlarged company has taken over a number of publications and moved to a large suite of rooms, 6 and 8 Bouverie street, E. C. This is in the heart of the publishing center of London. In the new quarters we shall be able to carry on the business of Marine Engineering with the greatest of economy and efficiency, and, what will be extremely important when peace returns, will be the opportunity to provide employment for something like 300 men when the army has done with them.

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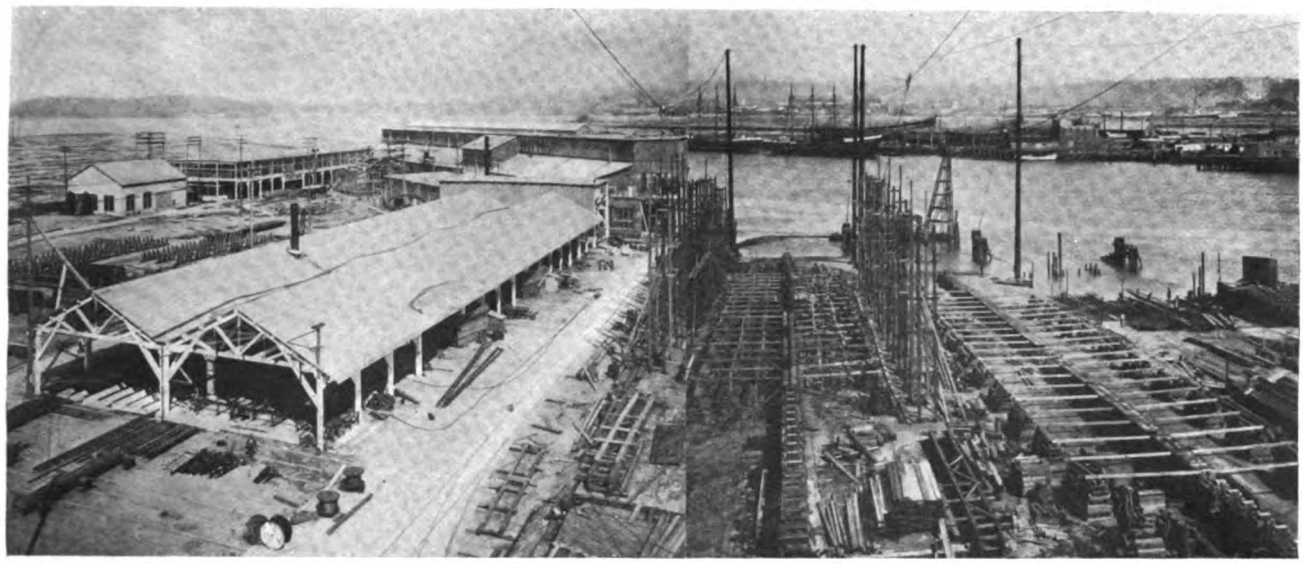

Fig. 1.—Panoramic View of New Ames Shipyard in Seattle

Ames Shipbuilding & Dry Dock Company

New Steel Shipbuilding Yard Established at Seattle—Plant Covers Seventeen Acres—Four Shipways and a Dry Dock Provided

BY GILBERT C. DOHM

THE ever-increasing demand for shipbuilding in the Northwest has made the Elliott Bay section of Puget Sound the leading shipbuilding center of the Pacific Coast. The Elliott Bay District has now four steel shipbuilding yards, which have been built with the evident idea of permanent establishment. These are the Seattle Construction & Dry Dock Company, the Skinner & Eddy Corporation, both previously described in issues of this periodical, J. F. Duthie & Company and Ames Shipbuilding & Dry Dock Company.

Built on a portion of what was once the Tide Land Section of Seattle, the new Ames shipbuilding yard is being developed on an even more elaborate scale than many of the other Pacific Coast yards. It is situated on West

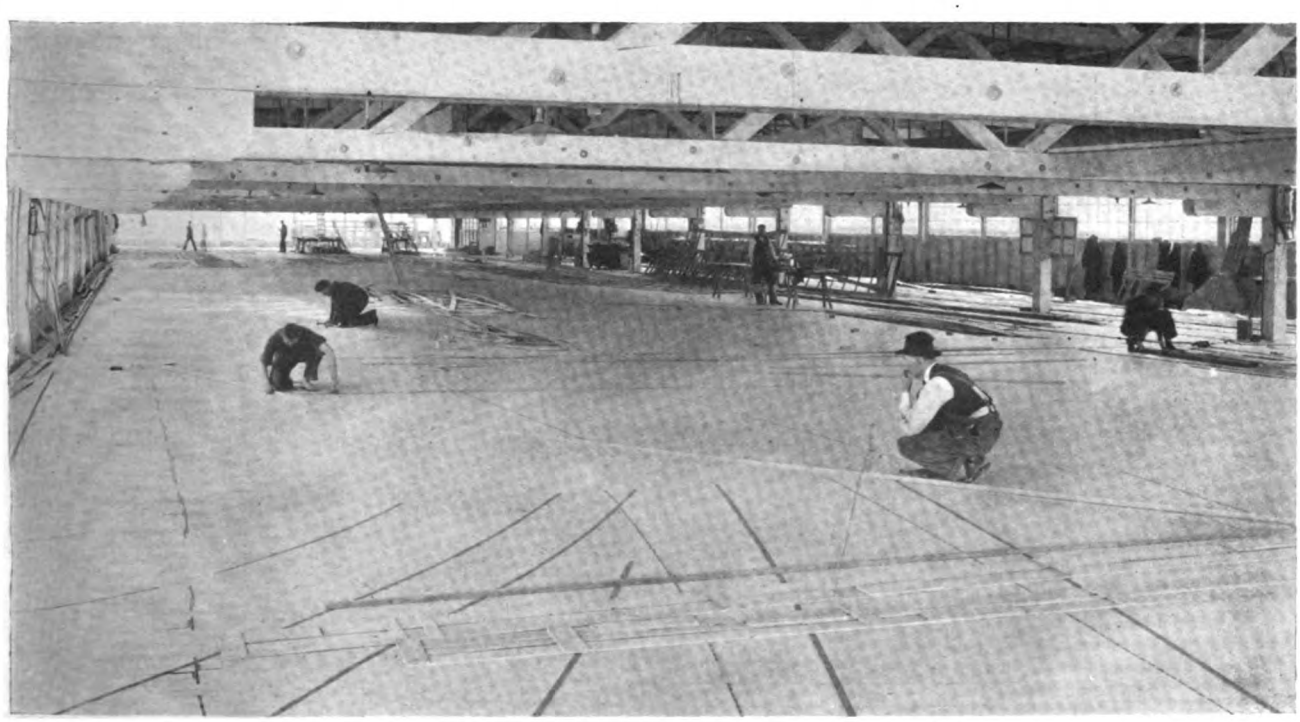

Fig. 2.—Interior of Mold Loft, showing Lines of 8,800-Ton Deadweight Cargo Steamer

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AMES SHIPBUILDING AND DRY DOCK COMPANY, SEATTLE, WASH.

Latest Addition to Steel Shipbuilding Facilities in Puget Sound

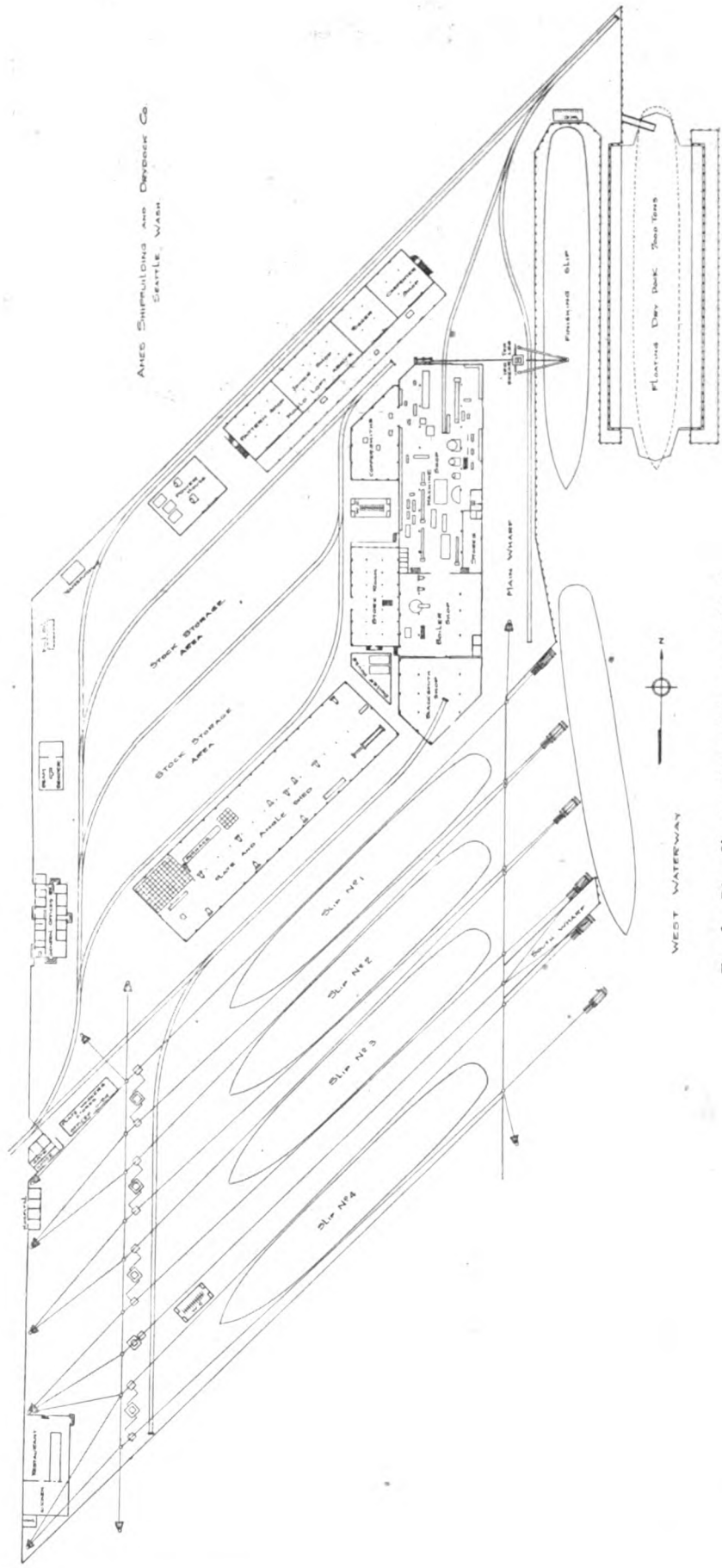

Fig. 3.—Plan Showing General Layout of Yard

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AMES SHIPBUILDING AND DRY DOCK COMPANY

New Puget Sound Shipyard Located at Seattle

Fig. 4.—Pattern and Joiner Shop

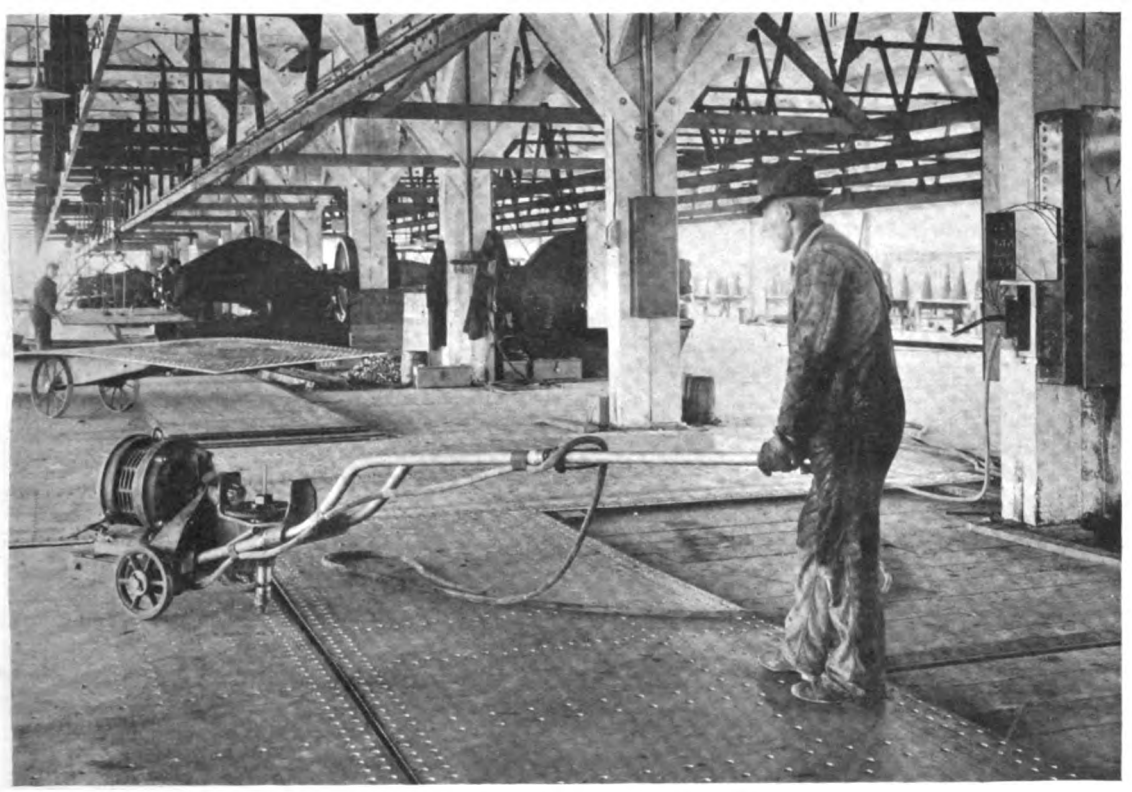

Fig. 5.—Portion of Plate and Angle Shop

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Waterway, where an unobstructed fairway leads into Elliott Bay, and is only a short distance from Seattle's busy waterfront and commercial center. This yard covers approximately seventeen acres and is directly connected with the main transcontinental railroads, which makes its location ideal for the handling of large work.

Preparations for the building of this plant were made late last year, the work having progressed so smoothly and rapidly that the company was enabled to lay the keels of two ships in March.

Construction of Buildings

The buildings are all of heavy mill construction, well braced and made up of sizes sufficiently great to withstand the shocks from the overhead traveling cranes, the radial cranes which serve individual machines, and the large overhead cranes which in the machine shop, boiler shop and blacksmith shop extend the total width of the building, and have a large carrying capacity. On account of this timber construction, efficient methods of fire prevention and control were immediately installed.

The layout of this plant is shown in Fig. 3. Much of the open space is used at present for the storage of plates and shapes, which material is now constantly arriving. A large space between the conveyor winches and the stem of the ships has been set aside for the storage of structures and parts built up or bent into shape beforehand, such as floors, frames, shaft alley framing, beams and brackets, etc.; and awaiting to be installed on their respective ships.

The power house, which is the source of all energy for the yard, is equipped with four Ingersoll-Rand compressors of 5,000 cubic feet capacity, which supply the compressed air for the drills, riveting and reaming machines, and bull riveters. These compressors are driven by Westinghouse motors. Steam for use in the blacksmith shop, plate and angle shop, yard heating system, winches, etc., is received from a 150 horsepower boiler, which is separate from the compressor house. As a large hydraulic press will be used for bending the plates, only angle furnaces were installed, and these are all fired by fuel oil. The plate and angle shop is fully equipped with planers, portable reamers, shears, rolls, drills, punching machines, etc.

Mold Loft

The mold loft is located above the pattern shop, joiner shop, riggers' shop and carpenter shop, and has now laid upon its floor the lines of an 8,800 ton deadweight cargo steamer, the keel of which is already laid. The floor is painted gray, which offers a much more pleasing color to work by than the generally used black. The walls of most of the buildings are glass paneled, which gives adequate light at all times.

The blacksmith shop, boiler shop, and machine shop are all under one roof and are connected by the same set of crane tracks, which run the full length of the building, thereby enabling material to be conveyed from one part of the building to another without first transferring. All the machinery and boilers to be used in the building of the ships will be constructed by the company.

Adjacent to the machine shop is the fitting-out wharf, 800 feet long by 60 feet wide, and at the end of the machine shop is a 100-ton shear leg. The finishing slip is located alongside of the wharf, and on the other side of the slip will be located a 7,000-ton dry dock and outer wharf.

The method of conveying material to the ships is accomplished by a system of aerial tramways, a system which is being used to a great extent in the Northwest. A unique feature of this particular yard is, however, the fact that the men operating the hoisting winches for each ship are located at the forward end of the slip in an operator's house elevated about 70 feet in the air. Two operators are stationed in each house, and in this way can communicate with one another when hoisting or lowering the material. The panoramic picture of this yard shown in Fig. 1 was taken from one of these houses and gives a good idea of the unobstructed view which the operators have, which enables them to do away with the bell signal system. The winches themselves are placed on the ground.

The hospital, which is divided into three sections, is entirely of white enameled finish and contains three beds, sterilizing apparatus, and operating tables, and is up-to-date in every respect.

A restaurant is being constructed by the company, as the plant is too far distant from the main part of town to permit the men traveling this distance at noon time. This restaurant will be be conducted by the company and a nominal charge for meals will be made. It is a two-story building with a large, spacious kitchen, and will accommodate approximately 250 men.

Two building slips are now completed and two more are now under construction. The company employs about 2,000 men and is working three shifts.

The officers of this company are Edgar Ames, president; David Hollywood, general manager; George W. Albin, secretary, and J. V. Patterson, consulting engineer.

Maritime Congress Proposed to Aid in Upbuilding the American Merchant Marine

While practically every great industry in the United States is indirectly interested in the building up of an American merchant marine, those directly, vitally and understandingly involved are the shipowner, the shipbuilder and the shipper. In all of the attempts which have been made in each succeeding administration to secure legislation fostering the American merchant marine and its allied industries there has been no co-ordinated effort on the part of the industries most vitally interested to bring about results. If a well organized body representing the interests of shipowners, shipbuilders and shippers, acting together, should form a coalition and work definitely for the upbuilding of the American merchant marine, there can be little doubt that many desired results could be brought about.

No more favorable time for the cementing of interests depending upon ocean transportation could be chosen than the present. The demands for ocean tonnage (never more urgent), due to the enormous growth of foreign trade by producers, manufacturers and shippers in the United States during the past two years, make it imperative that adequate provision be made for carrying on this commerce economically and efficiently in American ships.

With these needs facing the country, influential steamship and shipping men have suggested the formation of a maritime congress made up of delegates representing the interests most vitally involved in an American merchant marine. Such an organization could hold its conventions in some central location and could formulate an American maritime policy which would be authoritative and effective in influencing the public, and, in turn, Congress, toward the enactment of the necessary legislation for upbuilding an American merchant marine commensurate with the wealth, dignity and needs of a great nation.

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Letters from Marine Engineers

Discussion of the Design and Handling of Marine Engines, Boilers and Auxiliaries—Breakdowns at Sea and Repairs

This department is open to all readers of the magazine for the discussion of affairs in the engine room. All letters published are paid for at regular rates. Your ideas or experiences will be mutually helpful and interesting to other engineers. Write your letter now.

On Watch

What sort of use do you make of the time on watch? The natural answer would be, "I look after things and carry out the various duties of the watch." That's good; but do you make any mental progress when things are running smoothly and require but routine attention?

It is surprising how few of us make use of these moments to polish up the rust spots when the old engine is throbbing merrily along. The writer formed the habit of looking for things that could happen and mentally planning what he would do if such and such a thing happened and of thinking about improvements in different parts of the plant. Would one get more heat in the feed water by retaining a small amount of condensate in the lower part of the feed heater, or would it be more economical to let the exhaust steam pass right through?

Thoughts of this kind led to a number of practical experiments during many of my watches. It is surprising to note the endless number of things that are available in the plant to keep one's thinker busy, if he be so inclined. And Gee! how it makes the minutes slip by! Seeing into things, imaginative breakdowns, and what to do to correct them—this is a valuable trait. It puts new interest in your work and need not take your direct attention from your watch duties. The habit must be cultivated, and if your heart is in the profession you are following it does not take much effort. Many a time when an emergency came up the writer has been well repaid for the moments of inventive thinking when on watch.

I met a fellow who was serving in the capacity of first assistant, and has been for the past six years, yet he was the possessor of unlimited tonnage license in chief's grade. He said he had never got a show to use his chief's ticket. A little observation and quizzing soon told me why. He was waiting for an opportunity, he said. Now, as I have been through the mill, I know that he will keep on waiting, for opportunity doesn't knock loud enough for his kind to hear it. He will undoubtedly remain in the billet of first assistant until he gets busy and hunts for the opportunity and quits being satisfied as a first assistant.

I gleaned the facts from his chief; he told me that he was a good enough man for a chief's billet, if he only used his brains more often. "The trouble is that he wants me to do his thinking and planning and he is not observant when on watch. He never can anticipate a source of trouble, or invent a means of prevention, and whenever I drop down in the engine room on his watch, I find him sitting down, sort of dreaming. All notes of future repairs, or correction of poor conditions, come from the others and he remains content to let them find them."

What puzzled the writer after hearing this was how such a man obtained a ticket of the class that I have mentioned he possessed. Yet, after all, a license to operate does not imply that the holder will make a fit man for the position of chief engineer, for almost anyone who will spend time enough in poring over a few marine engineering text books and indicator catechisms of the usual question-and-answer type, can obtain a ticket; most especially if he be fortunate enough to get questions along the same lines he has read.

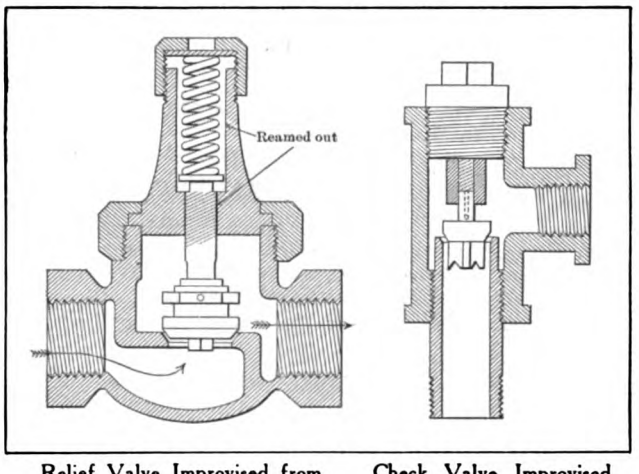
Such a fellow could pass a fair examination and obtain a percentage high enough to entitle him to a ticket but still be lacking in the essential qualities that go to make a good engineer. One who for six years or more remains at a standstill should pick himself to pieces and find out what is wrong. There will be many good chiefs in demand for the merchant tonnage now being built and the men to fill the billets will be thinkers.

PROGRESSIVE ENGINEER.

Kinks

While serving as junior engineer on board of a tramp steamer I picked up a few kinks. The sketches show a couple of improvised fittings that were made for use in the installation of a forced lubrication system for the main circulating engine.

In tropical climates it was necessary to run the circulating pump nearly full speed and to lubricate it sufficiently



Relief Valve Improvised from Old Globe Valve

Check Valve Improvised from a Tee

to keep things cool. With hand oilers or a drip feed system this was not only very difficult but called for considerable extra attention and waste of oil, so the chief decided to fit things up for forced lubrication. As we were to lie in Jolo, Philippine Islands, for a week, we started the job.

As we progressed we were obliged to improvise many things, among which were a couple of check valves and a relief valve. The material came from a bin of old fittings in the storeroom. The sketches are self-explanatory, so nothing will be said of them except that there is some lathe work involved. The relief valve was required to raise or lift at 10-pounds pressure, and the spring was made of ⅛-inch steel wire. The size of the valve used was 1 inch.

These are not economy kinks. We would have been able to purchase the fittings cheaper than we could have made them, but we could not get them in the port where we were located. They might be handy to some fellow in the same fix.

JUNIOR ENGINEER.

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Keep Posted

Did someone to you a question ask
About certain features of his task?
Or something or other about the plant
To which the answer you couldn't grant?
Now, didn't it make you feel quite cheap
To think that your brain was part asleep?

How queer it does make a fellow feel,
When he can't answer right off the reel,
And finds he has to study a bit,
So that his brain may be better fit
To answer questions his men might ask
Of any details in daily task.

You had better study, engineer,
You must not let spots of rust appear;
One of your men might chance to inquire
What causes a clinker in the fire,
About CO_2, how to explain—
Is the answer ready in your brain?

He might ask you this, which might you stump—
Figure the horsepower of a pump;
Or of a valve, the negative lap—
The answer you cannot tell, mayhap.
He surely thinks you can answer him,
So it's best to keep your brain in trim.

Study your text books and journals through,
Broaden your knowledge as good men do;
Prepare for offhand questions well,
So that the answers you surely can tell;
Get all the information you can,
And be an efficient, skilful man.

Concord, N. H. C. H. WILLEY.

NEW BOOKS FOR MARINE ENGINEERS

STRENGTH OF SHIPS. By A. J. Murray. Size, 5⅝ by 8¼ inches. Pages, 400. Illustrations, 215. Folding plates, 3; folding table, 1. New York and London: 1916. Longmans, Green & Company. Price, $5.00 net.

If it were not for the fact that the scantlings for steel ships of various types and proportions were arbitrarily fixed by the classification societies, the need for text and reference books containing the detailed application of mathematical formulæ for the determination of size and strengths of parts of the ship's structure would long ago have brought before the public books dealing with the strength of ships. As matters stand, however, the ship designers are relieved of much laborious work in determining in each case the strength of parts by the existence of the rules and regulations of the classification societies. Notwithstanding this, however, the increasing complexity of ship construction, the development of new designs and departures from standard arrangements and proportions are producing a growing demand for a fuller and more widespread knowledge of the strength problems underlying ship design. This book, therefore, which is claimed to be the first of its kind published in the English language, should meet such a demand. The work is the outcome of practical experience and is treated from the practical standpoint. The elements of the theory of stress, strain and elasticity are concisely set forth, and later their application is shown to problems of design comprising beams, columns, shafts, bulkheads, plating, riveting, brackets, rudders and miscellaneous fittings, while considerable space is devoted to longitudinal and transverse strength. In all, the book contains fourteen chapters; and while much of it is largely of academic interest, nevertheless it will undoubtedly be found of practical value in many respects for ship designers.

STEAM TURBINES. By William J. Goudie, B. Sc. Size, 5½ by 8½ inches. Pages, 520. Illustrations, 230. London: 1917. Longmans, Green & Company. Price 12/6 net.

The first portion of this book is devoted to detailed descriptions of commercial types of steam turbines now on the market, while the second portion is devoted to what may be termed the technical part of the subject; that is, the mathematical discussion of the action of steam in the turbines and the determination of the size and shape of the various parts. While the book has been written primarily to suit the requirements of engineering students, it will also be found useful by engineers who have to deal with the design and operation of turbines, for the reason that the production of the commercially successful turbine depends to a considerable extent on the use of design coefficients derived from practice, and in this book these have been applied to suit the conditions of each particular case. The fundamental principles underlying any scheme of design are clearly defined and the practical limitations to the application of theory which experience has shown to be necessary in successful turbine work are stated. By the introduction of practical coefficients and data quoted from various reliable sources, the author has endeavored to place a practical system of calculation before the reader. The matter is arranged progressively, so that the reader may work through the detailed calculations relating to the various portions of the machine in a logical order, finally ending with a general method of calculation for the provisional determination of the general proportions of any given type to fulfill specific conditions of operation. The book deals only with the turbine proper, as the allied subjects of condensers and auxiliaries have not been touched upon.

THE SUBMARINE TORPEDO BOAT: ITS CHARACTERISTICS AND MODERN DEVELOPMENT. By Allen Hoar. Size, 5¼ by 7¾ inches. Pages, 211. Illustrations, 84. Folding plates, 4. New York: 1916. D. Van Nostrand Company. Price, $2.00 net.

While this book was written for the general reader, it is of value to technical men and engineers, as it faithfully explains the inherent characteristics of the submarine boat, the problems involved in its design and construction, the difficulties of operation and its present limitations. The writer even goes so far as to prophesy its future possibilities, although this is a field in which few are capable of speaking with authority.

In their present stage of development the most important feature in the design of submarines is the means of propulsion both on the surface and under water. Only a brief chapter is given to this topic, and it is to be regretted that this question was not dealt with more fully.

Useful information is given regarding the means of defense against submarine attack, and the tactical evolutions of the submarine as well as the handling of torpedoes. The text is well illustrated not only by excellent photographs but also by drawings and diagrams giving the reader an excellent idea of the details of modern submarine boats.

THE MECHANICAL WORLD POCKET DIARY AND YEAR BOOK has reached its thirtieth year of publication. This volume, size 4 by 6 inches, contains 330 pages of useful engineering notes, rules, tables and data. Many sections of the book have been thoroughly revised and much new information has been added. The book is published in England by Emmott & Co., Ltd., Manchester, and in the United States by Norman, Remington & Co., Baltimore, Md. Price, postpaid, 40 cents.

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Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding will be Answered in this Department

BY H. A. EVERETT *

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so. Indicator cards taken from marine engines will be carefully analyzed, the defects pointed out and the horsepower calculated, provided complete data are sent with cards.

Receiver Pressures in Triple Expansion Engine

Q. (871).—How are the receiver pressures in triple expansion engines figured out? Give an example showing each cylinder doing the same amount of work, or as near to it as can be obtained?

A. (871).—If the engine is designed or built, the desirable receiver pressures for wide open throttle runs may be *roughly* calculated by the following empirical expressions which have been derived from a large number of trials of engines both of the express and merchant types, all of which had good distributions of work:

$$\text{Pressure in first receiver} = \frac{\text{Boiler pressure} \times \text{volume high-pressure cylinder}}{\text{Volume intermediate-pressure cylinder}}$$

$$\text{Pressure in second receiver} = \frac{2.0\ (\text{pressure in condenser} + 8\ \text{pounds})}{\text{Cut-off in low-pressure cylinder}}$$

All pressures are absolute.

Cut-off in low pressure cylinder is expressed as decimal of stroke.

There is no way of accurately predicting offhand the probable pressures, as they are affected greatly by the details of construction of the engine, and it should be borne in mind that the only reliable gage as to whether an engine is developing equal work in each cylinder is from the indicator diagram.

Dimensions of Propeller for Motor Boat

Q. (872).—I have a motor boat which has the following dimensions: Length over all, 40 feet; length on waterline, 39 feet; beam (extreme), 5 feet 9 inches; beam (load water line), 4 feet 10 inches; draft (extreme), 2 feet 3 inches; draft (mean molded), 9 inches; displacement, 3,950 pounds. Will you please tell me what speed she will make if I put in a 42 brake horsepower motor (1,000 revolutions per minute), and what dimensions the propeller should have?

A. (872).—If the hull is well formed, 42 brake horsepower should drive it at 18.5 knots, or 21.5 miles per hour. A suitable propeller would be one having a diameter of 18.3 inches and a pitch of 26.5 inches with three blades of large width and having sharp edges.

Wear on Crosshead and Crank Pin Brasses

Q. (873).—Where is the most wear, in the crosshead pin and brasses, or the crank-pin and brasses, and why?

A. (873).—The most wear occurs in the crankpin brasses. The wristpin brasses should require very little attention. The crankpin itself wears but little and the wristpin, barring accidents, should run for years without needing to be trued up. The principal reason why the crankpin brasses wear more than the wristpin brasses is that the distance the surfaces rub by each other is much greater there than at the wristpin. The designed load per unit of area of bearing at the crankpin is about one-half that allowed at the wristpin, but the rubbing speed of the crankpin bearing is about fifty times as great as the average rubbing speed of the wristpin bearing, which is, moreover, a reciprocating motion.

Clearances in Main and Crank Pin Bearings

Q. (874).—What clearances should be allowed in adjusting main and crank-pin bearings of a 3,000 indicated horsepower marine engine?

A. (874).—Bearings of large size are usually adjusted to give a "lead" or radial clearance of the cap of from eight to fourteen-thousandths (0.008 to 0.014) inch. Small bearings capable of nice adjustment and which receive good care may have caps set to give a "lead" of 0.0005 inch.

Cylinder Proportions in Triple Expansion Marine Engine

Q. (875).—Will you please tell me what consideration regulates the cylinder proportions in a triple expansion marine engine; that is, what determines the selection of the ratios of the high-pressure cylinder to the low-pressure cylinder, and the intermediate to the low-pressure?

A. (875).—Usually the low pressure cylinder diameter is first determined by any of the methods commonly given in text books. With this settled, the diameter of the high pressure is then a function of the number of expansions to be used and the cut-off in the high pressure cylinder. Dividing the volume of the low pressure cylinder by a number of expansions gives the volume of the high pressure cylinder at cut-off and selecting a value for cut-off, the cylinder diameter becomes determinate. Cut-off in the high pressure cylinder occurs usually at from 70 to 85 percent of stroke, the larger values being used where it is desirable to keep down the weight and size of the high pressure cylinder. The intermediate cylinder is usually determined in accordance with the following expression:

$$\text{Diameter intermediate-pressure cylinder} = K\ (\text{diameter low pressure} \times \text{diameter high pressure})^{1/2}$$

For merchant ships, K = 1.0, for naval vessels it ranges from 0.9 to 1.0, as these usually have a much smaller number of expansions.

Indicated vs. Brake Horsepower

Q. (876).—What is a reasonable value for the percentage of the indicated horsepower that moderate-sized reciprocating marine engines will deliver as brake horsepower? Is it 70 percent, 75 percent or 80 percent, or what? For a specific example take a triple expansion condensing engine that I have in mind, which develops about 900 indicated horsepower at 180 revolutions per minute with steam at the throttle of 175 pounds. I wish to predict what the brake horsepower will be, and should be very glad if you would give me the latest information.

A. (876).—The value of the mechanical efficiency

$$\left(\frac{B.H.P.}{I.H.P.}\right)$$

for modern marine engines varies considerably with the size of the unit and is affected by the condition of the engine as regards alinement, bearings, etc. A commonly accepted value for engines of 2,500 indicated horsepower and over, of good construction and condition, is 92 percent. For an engine of the size you mention 85 percent to 88

* Professor of Marine Engineering, Post Graduate Department, United States Naval Academy, Annapolis, Md.

† "Design of Steam Boilers," Haven & Ewett.

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percent would be a reasonable range. Engines of larger size have been quoted as having mechanical efficiencies of 95 percent or over, but these values are abnormal, as also are values below 85 percent.

Superheat in First Effect of Double Effect Evaporator

Q. (879).—How much superheat should be carried on the first effect of an evaporator running double effect? The plant provides make-up feed and water for ship's purposes. The evaporator operates on live steam at 150 pounds pressure gage in the first effect and has a rated capacity of 7,500 gallons per twenty-four hours. How will it affect the capacity if I operate the two units single effect?

A. (879).—Effective separation is better than carrying any superheat. The only reason for superheating is to prevent the vapor carrying over entrained drops of salt water and thus contaminating the water delivered. Superheating, however, accelerates corrosion and pitting, and best practice now tends toward large vapor space and effective mechanical separation.

The *capacity* of a double effect is no greater than a single effect operating between the same range of temperatures, but the *economy* is about twice as great. So, if you cease operating the two units which you have, in double effect, and operate each single effect between the 150 pounds and the same back pressure as now is used on the second effect, you will obtain approximately twice as much total water, as *each* unit will give the *same* amount that is now produced by the whole plant, but the water delivered per pound of live steam will be about one-half that which you are now obtaining and you will use altogether approximately four times as much live steam and obtain nearly twice as much feed.

Efficiency as Basis for Comparison of Steam Engine Performance

Q. (880).—Will you kindly tell me what is the proper efficiency to use as a basis for the comparison of steam engine performance? I have found both of the expressions given below used and they do not agree for a given set of conditions. To make the case a concrete one, assume that I have an engine operating between 150 pounds gage and 26 inches vacuum. What is the ideal efficiency?

Formula I

$$\text{Ideal efficiency} = \frac{T_1 - T_2}{T_1}$$

Formula II

$$\text{Ideal efficiency} = \frac{H_1 - H_2}{H_1 - q_2}$$

Where T_1 and T_2 are the absolute temperatures at supply and discharge.

H_1 and H_2 are the heat contents at supply and discharge.

q_2 is the heat of the liquid at the discharge pressure.

A. (880).—The two expressions you quote are each correct for a certain ideal cycle, the first for the Carnot cycle and the second for the Clausius or Rankine cycle. The second is preferable as a basis for steam engine comparison. Fundamentally the two are the same, however, the only difference being in the manner in which the heat is added. The basic expression for efficiency of any engine which transforms heat into work is

$$\text{Efficiency} = \frac{\text{Heat transformed into work}}{\text{Heat supplied}},$$

which is the same as

$$\text{Efficiency} = \frac{\text{Heat supplied} - \text{heat rejected}}{\text{Heat supplied}}$$

when the engine transforms *all* of the heat available in its range of operation into work, and this is what the ideal engine does.

The Rankine cycle assumes steam is admitted to the cylinder at constant pressure up to the cut-off, at cut-off adiabatic expansion occurs (no heat passes into or out of the cylinder) to release, then, the steam is exhausted on the back stroke. The heat supplied to generate one pound of steam and push it into the cylinder up to cut-off is the heat contents minus the heat of the condensate ($H_1 - q_2$). The heat rejected is the heat that is given out in the exhaust after release or $H_2 - q_2$ as the condensate is assumed to be fed directly back to the boiler. The following is then the efficiency:

$$\text{Efficiency} = \frac{(H_1 - q_2) - (H_2 - q_2)}{H_1 - q_2} = \frac{H_1 - H_2}{H_1 - q_2}$$

(The q_2 is always looked up for the back pressure in the condenser regardless of what the feed temperature may be.) An engine operating with dry steam at 150 pounds gage, 26 inches vacuum, has an ideal or Rankine efficiency, figured as follows:

150 pounds gage = 164.7 pounds absolute.
Entropy = 1.56 for dry steam.
26 inches vacuum = 1.95 pounds approximate.
At entropy = 1.56, and p_1 = 164.7 pounds.
At entropy = 1.56, at p_2 = 1.95 pounds.

H_1 =	1195	B. T. U.	1195
H_2 =	904	q_2 =	93
$H_1 - H_2$ =	291	$H_1 - q_2$ =	1102

$$\text{Efficiency} = \frac{291}{1102} = 26.4 \text{ percent.}$$

NOTE.—H_1 and H_2 must be looked up at the entropy corresponding to the initial pressure and quality. The computation can most readily be made from steam and entropy tables of Peabody, or any temperature entropy diagram.

The other expression for efficiency applies to the Carnot cycle, which considers that there is no steam *supplied* and *exhausted*, but that a constant amount remains under consideration all the time and that the addition and subtraction of heat changes its state and makes it do external work. The Carnot efficiency is sometimes used for calculating ideal plant efficiency, considering the boiler, engine, etc., as one unit. The Rankine is, however, preferable for comparison of *engine* performance.

Passes in Surface Condensers

Q. (881).—Are marine condensers ever built with the circulating water making any different number of passes than two?

A. (881).—Yes, modern condensers for high speed vessels are frequently single pass condensers.

Determination of Superheat in Steam

Q. (883).—How can you tell whether or not steam is superheated?

A. (883).—Measure the pressure and temperature of the steam by a steam gage and a thermometer. Look up in the steam tables the temperature corresponding to the gage pressure plus 14.7 pounds. If the temperature as given by the thermometer is higher than this, the steam is superheated and the amount of superheat in degrees is the excess of the observed temperature over that given by the steam tables. The temperature is best obtained by inserting a thermometer well filled with oil or mercury, into the steam line and placing the thermometer in this. Care should be taken to apply a stem correction to the reading. For example, suppose the gage shows 150.3 pounds and the thermometer actually reads 380 degrees F. Applying a stem correction of about 6 degrees for this case, the true temperature is 386 degrees. From the steam tables the temperature at 150.3 pounds + 14.7 pounds, or 165 pounds absolute, is 366 degrees F., the superheat is then 386 degrees — 366 degrees = 20 degrees.

ECKLIFF CIRCULATORS are well represented in ships of the United States Government now under war orders. Several of the larger Scotch-boilered ships of the U. S. Navy and the War Department are Eckliff-equipped; also boats of the U. S. Coastguard Service, U. S. Lighthouse Service, U. S. Coast and Geodetic Survey and Bureau of Immigration. In addition to these, Eckliff circulators have been installed in the boilers of a large number of freighters, steam yachts, fishing steamers and other craft.

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Shipbuilding and General Marine News

Contracts for New Ships—Marine Terminal Improvements—Recent Launchings—Improved Appliances—Personal Items

With an urgent demand for every available ton of shipping that can be produced in the shortest possible time, by both the steel and wooden shipbuilders of the United States, the resources of the steel and machinery markets will be taxed to the utmost for material and equipment. A considerable list of new equipment has been issued for the government navy yards and also by some of the larger private shipbuilding establishments. In addition to this, numerous new shipbuilding companies are being incorporated, sites secured and plans prepared for shipbuilding facilities. Woodworking machinery is especially in demand.

One of the most serious problems connected with the urgent demand for vessel tonnage is the securing of skilled and unskilled labor for this work. The Navy Department is in urgent need of ship draftsmen. Millions of dollars are available for new construction and for facilitating construction already begun, but all the shipbuilding work undertaken by Government yards is retarded by a shortage of ship draftsmen. Applications for such positions will be received by the United States Civil Service Commission, Washington, D. C., at any time, and those found qualified will be offered employment at once, at salaries ranging from $3.28 to $6.00 and over per diem.

Strenuous efforts are also being made to secure carpenters for employment in building the large fleet of wooden cargo ships which is now being undertaken by the United States Shipping Board.

Announcement was made on April 11, by the Secretary of the Navy, that Charleston, W. Va., has been selected as the location for the Government armor plate plant for which Congress has appropriated $11,000,000. The construction of the plant will be commenced at once and driven to quick completion.

Shipping Committee Appointed to Consider Methods of Increasing Tonnage

At a meeting of the Council of National Defense at Washington, D. C., on April 21, there was created a committee of shipping to advise with the United States Shipping Board, and to report to the Council, as to the best method of increasing tonnage available for shipment to the Allies.

This committee consists of Hon. William Denman, chairman of the Federal Shipping Board; P. A. S. Franklin, president, International Mercantile Marine Company; H. H. Raymond, president, Coastwise Shipping Association; Hon. Eugene T. Chamberlain, commissioner, Bureau of Navigation, Department of Commerce; D. T. Warden, manager of foreign shipping department, Standard Oil Company; L. H. Sherman, vice-president, W. R. Grace & Company; A. H. Bull, of A. H. Bull & Company, and Frank C. Munson, of the Munson Steamship Line.

Electric Drive for Battleships Colorado and Washington

Contracts totaling approximately $2,000,000 have been placed recently with the Westinghouse Electric & Manufacturing Company, of East Pittsburg, Pa., by the New York Shipbuilding Company, for furnishing the necessary electrical equipments for the propulsion of the new super-dreadnoughts *Colorado* and *Washington*.

The equipments to be furnished are practically duplicates of that contracted for by the Navy Department for the U. S. S. *Tennessee*, now building at the New York Navy Yard. The four propellers, as in the case of the *Tennessee*, instead of being mechanically connected to turbines, are to be driven by individual motors. The current for the motors will be furnished by two turbine generators.

In addition to the main generating equipments and propelling motors, the contracts include auxiliaries for the main turbine generators and smaller auxiliary turbine generators for supplying light and power throughout the ships. Westinghouse electric motors will also be utilized for doing nearly all the work on board, from raising the anchor to steering.

Board Appointed to Value Merchant Vessels Offered to the Government

A board of appraisal to appraise the value of all the vessels offered for Government use has been appointed by the Secretary of the Navy. The board consists of Captain A. S. Halstead, U. S. N., now stationed at the Naval War College, Newport, R. I.; Naval Constructor H. G. Gillmor, U. S. N., now on duty with the Board of Inspection and Survey, and Lieutenant-Commander E. C. Kalbfus, U. S. N., on duty with the General Board. In addition, the Secretary directed that three civilians be added. They are Daniel Bacon and Stevenson Taylor, of New York City, and Albert L. Swasey, of Taunton, Mass. These three civilians have received the rank of lieutenant-commander in the Naval Reserve. The board will have offices with the Naval Reserve at 26 Cortlandt street, New York City.

Shipbuilding Contracts

According to reports, lake shipyards have recently received orders to build about seventy steel ships for the overseas trade, for delivery during 1918. Most of these boats are of Welland Canal size, but several are larger and will be taken through the canal in two sections. It is reported that thirty-three of these boats will be built by the American Shipbuilding Company, Cleveland, Ohio, and twenty-nine by the Great Lakes Engineering Works, Detroit, Mich.

According to latest reports, the Cunard Steamship Company, Ltd., whose New York office is 24 State street, is planning to place orders in this country for 114 ships, to range in size from 8,000 to 17,000 tons, and to cost about $120,000,000.

The Mann Yacht Building Company, Baltimore, Md., has received a contract from the city of Baltimore to build a 45-foot police boat.

The Herreshoff Manufacturing Company, Bristol, R. I., has received a contract from A. I. Du Pont, Wilmington, Del., to build a fast scout patrol boat, 110 feet long.

The American Shipbuilding Corporation, Spokane, Wash will build eight five-masted auxiliary schooners at its Warrentown, Ore., yards.

The Secretary of the Navy has awarded contracts for the construction of twenty-four torpedo boat destroyers, as follows: To the Union Iron Works Company, San Francisco, Cal., 10; to the Fore River Shipbuilding Corporation, Quincy, Mass., 8, and to the Wm. Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa., 6.

The Cunard Line, 21 State street, New York, is credited with having placed orders in the United States for a total of thirty-eight steamships, including ten ships to be built by the Ames Shipbuilding & Dry Dock Company, Seattle, Wash.

The Harlan & Hollingsworth Corporation, Wilmington, Del., has received a contract from the United Fruit Company, Boston, Mass., to build four steamships, making a total of eight steamers which the United Fruit Company is now building in the United States.

The Wm. Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa., has received a contract from W. R. Grace & Company, Hanover Square, New York, to build two more steamships.

According to recent reports, Seattle shipbuilding plants now have under contract ships aggregating a total contract price of more than $64,000,000.

John Coughlan & Sons, Vancouver, B. C., who are building three 8800-ton steel steamers for Norwegian interests, have received a contract from the British Government to build three steel steamers of the same size.

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The New Jersey Dry Dock & Transportation Company, Elizabethport, N. J., is building a steamship for the Moore Lumber Company, two tugs for the Central Railroad of New Jersey, 143 Liberty street, New York, and a steam lighter for the Lehigh Valley Railroad Company, 143 Liberty street.

F. S. Bowker & Sons, Phippsburg, Me., have an order to build a 700-ton four-masted schooner.

Shipyard News

The Navy Department, Washington, D. C., is preparing plans for extensive improvements at the Brooklyn, Portsmouth, Philadelphia, Norfolk, Charleston and Mare Island Navy Yards. Eighteen million dollars has been appropriated for the purpose, and of this about $6,000,000 will be used in enlarging the League Island Navy Yard at Philadelphia.

The Navy Department has given a contract to the Maryland Dredging & Contracting Company, Baltimore, Md., for the construction of the new dry dock of the League Island Navy Yard. This dry dock will cost about $3,000,000, and will be 1,100 feet long, 200 feet wide and 80 feet deep.

The Bureau of Yards and Docks, Navy Department, Washington, D. C., is having plans drawn for the addition of a machine shop to the Brooklyn Navy Yard to cost about $400,000.

The Sun Shipbuilding Company, 1428 South Penn Square, Philadelphia, Pa., is planning large additions to its yard at Chester, Pa.

The Fore River Shipbuilding Corporation, Quincy, Mass., will spend about $1,500,000 to build a new set of ways, as a result of receiving a contract to build one of the new battle cruisers.

The Columbia River Shipbuilding Company, Portland, Ore., expects to begin ship building in a few days. This concern is one of those which is reported to have contracts to build two ships for the Cunard Line, besides orders received for six steamships for Norwegian parties.

The Hanlon Dry Dock & Shipbuilding Company, Oakland, Cal., is planning to spend $150,000 in the installation of metal-working machinery. This company is said to have received contracts to build two 5,000-ton steel freight steamships.

The F. O. Smith Shipbuilding & Dry Dock Company, Norfolk, Va. has let a contract to build a machine shop, storeroom, and boiler and blacksmith shop.

The Rolph Coal & Navigation Company, San Francisco, Cal., which recently bought the H. D. Bendixson Shipyard at Eureka, Cal., has bought 2,000 additional feet of water front, with the intention of enlarging the plant.

The Pacific Coast Shipbuilding Corporation has bought a site at Alviso, Cal., and is planning a wooden shipbuilding plant.

J. P. Clark, Los Angeles, and Henry M. Coit and George W. Bush, of San Diego, Cal., are organizers of a company to operate a shipbuilding plant at San Diego. It is reported that they have already secured a tract of land.

J. W. Paterson, Aberdeen, Wash., is at the head of a project to build a shipyard in Aberdeen. He is reported to have already secured contracts to build several vessels.

The National Shipbuilding Company, Seattle, Wash., has been reorganized, with a capital of $2,000,000, by William J. Fisher, Tacoma; George A. Lee, Seattle, and Judge Zent, Spokane.

The Wilmington Canning Company, Los Angeles, Cal., has announced that the company is planning the construction of a shipbuilding plant, and that it has secured 150 acres of land and will begin operations immediately.

Land recently purchased opposite New London, Conn., in the town of Groton, is to be used by the Groton Iron Works to establish a large shipyard. It is understood that $1,000,000 is to be spent. Full information regarding the yard can be had by addressing E. O. Cutler, Palmer Shipbuilding Company, Noank, Conn.

McBride & Law, Beaumont, Tex., have purchased land and will establish a shipyard of sufficient capacity to build six wooden vessels at one time, the vessels varying from 500 to 2,000 tons capacity.

George W. Bush, Marsh-Strong building, Los Angeles, Cal., has made application to the City Council of San Diego for a lease of land, with the intention of erecting a shipbuilding and repair plant.

Preparations are under way in Canada for the establishment of a great shipbuilding industry under Government aid. J. W. Norcross, vice-president and managing director of the Canada Steamship Lines, Toronto, Can., has been appointed Director of Shipbuilding of the Dominion of Canada.

The Lone Star Shipbuilding Company has been incorporated, with a capital stock of $2,000,000, for the purpose of building a shipyard at Beaumont, Tex. George B. Leighton, of Boston, is president of the company, and is said to have a contract to build ten schooners.

The Coast Shipbuilding Company, Portland, Ore., has been organized, with a capital stock of $400,000, by James B. Kerr, A. L. Mills, Donald W. Green and Charles E. McCulloch, all of Portland.

Reed Bros., South Somerset, Mass., are rebuilding and enlarging their shipyard.

George W. Moore, Bandon, Ore., is at the head of a group of capitalists who are said to be planning the erection of a shipbuilding plant in Bandon.

F. C. Knapp, president of the Peninsula Shipbuilding Company, Portland, Ore., announces that plans are being made for the enlargement of the yard.

The Manistee Iron Works, Manistee, Mich., has been purchased by the Northern Transportation Company, of Baltimore, Md. The new owners will immediately begin the construction of six wooden barges, each to have a carrying capacity of 3,000 tons.

The West Waterways Boat Building Company, Seattle, Wash., has been incorporated to build fishing vessels, launches, etc.

The Everett Shipbuilding Company, Everett, Wash., has been incorporated by D. W. Locke, A. J. Stohr, R. J. Weekin and others.

The Columbia Transportation System is being formed to build a shipbuilding plant on the Columbia River near Portland. Wallace R. Struble, secretary of the Columbia & Snake River Waterways Association, Portland, Ore., is one of those interested.

John F. Craig, Long Beach, Cal., has acquired a site for a shipbuilding plant, which he plans to build immediately.

It is reported that J. Fred Larsen, Portland, Ore., is about to establish a wooden shipbuilding yard at Florence, Ore.

The Shallow Water Boat Company has acquired the plant of the Ripley Steel Boat Company, Alton, Ill., and, according to report, will use it to manufacture submarine chasers and similar craft.

The Housatonic Shipbuilding Company, Stratford, Conn., has been incorporated to build wooden ships. The new company has acquired 40 acres of land on the Housatonic River. Fred E. Morgan is president and Carl Foster treasurer. It is reported that work will shortly be begun on ten schooners.

It is reported that the plant of the Standard Cast Iron Pipe Company, Bristol, Pa., is to be converted into a shipbuilding yard.

J. W. Hansbrough has bought 52 acres of water front at Vallejo, Cal., and is reported to be about to erect a shipyard

Henry Piaggio, Gulfport, Miss., is planning to build a shipyard and is in the market for woodworking machinery.

The Downey Shipbuilding Corporation, New York City, has been incorporated in Delaware, with a capital of $5,000,000, to construct and operate a local shipbuilding plant. Wallace Downey, 120 Broadway, head of the new organization, has recently acquired the structural steel and iron plant of Milliken Bros., Inc., Milliken, Staten Island, including about 1,800 feet of water front property, for the proposed works: an extensive shipbuilding department with six construction slips will be installed. The plant will specialize in the building of freighters of standardized type. Herbert E. Latter and C. M. Rimlinger, Wilmington, Del., are local incorporators.

The R. G. Packard Company, Twenty-eighth street, Bayonne, N. J., manufacturer of dredging machinery, has been granted riparian rights to property fronting on the Raritan River, near South Amboy, by the State Board of Commerce and Navigation, for a consideration of about $13,400. The company is said to be planning for the erection of a shipbuilding plant on the site.

To meet the demand for forgings that has developed with the shipbuilding industry a new company has been formed, which will erect a large plant on Whatcom avenue in Seattle. This company, the Pacific Engineering & Construction Company, has already started work on its shops, and their hydraulic forging presses, drop hammers, steam hammers and other equipment are on their way there from the East. R. C. Monteagle, formerly assistant general manager of the Seattle Construction & Dry Dock Company, is president and general manager of the new concern.

The Skinner & Eddy Shipbuilding Company has acquired a 15-acre site, including their present plant, for a price that has been given out at $1,500,000. This will give them much

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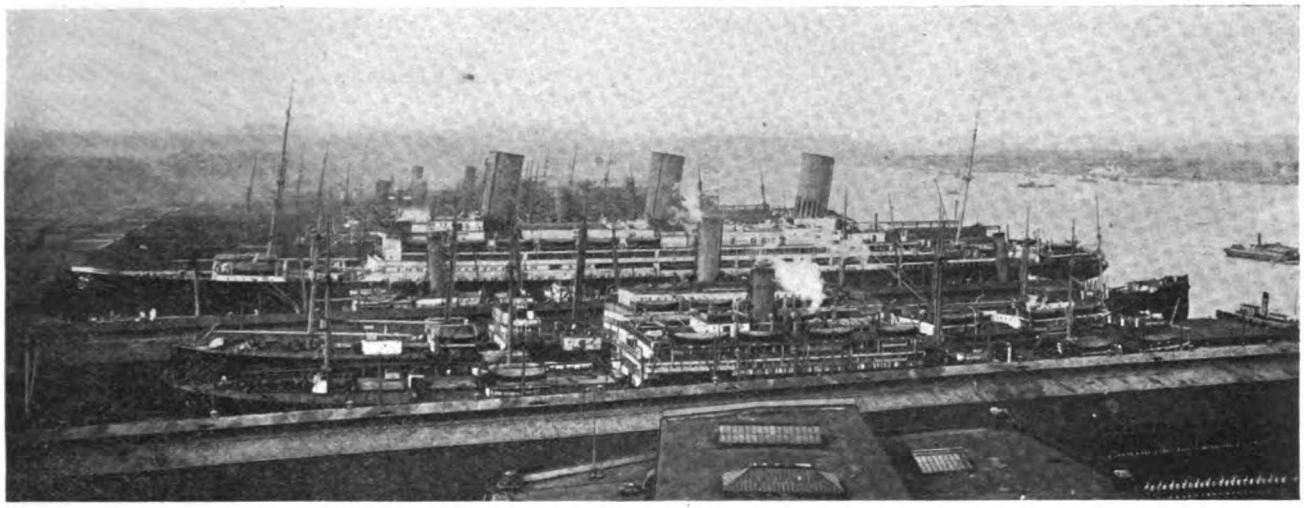


German Vessels at Hoboken, N. J., Piers Seized by the United States Government

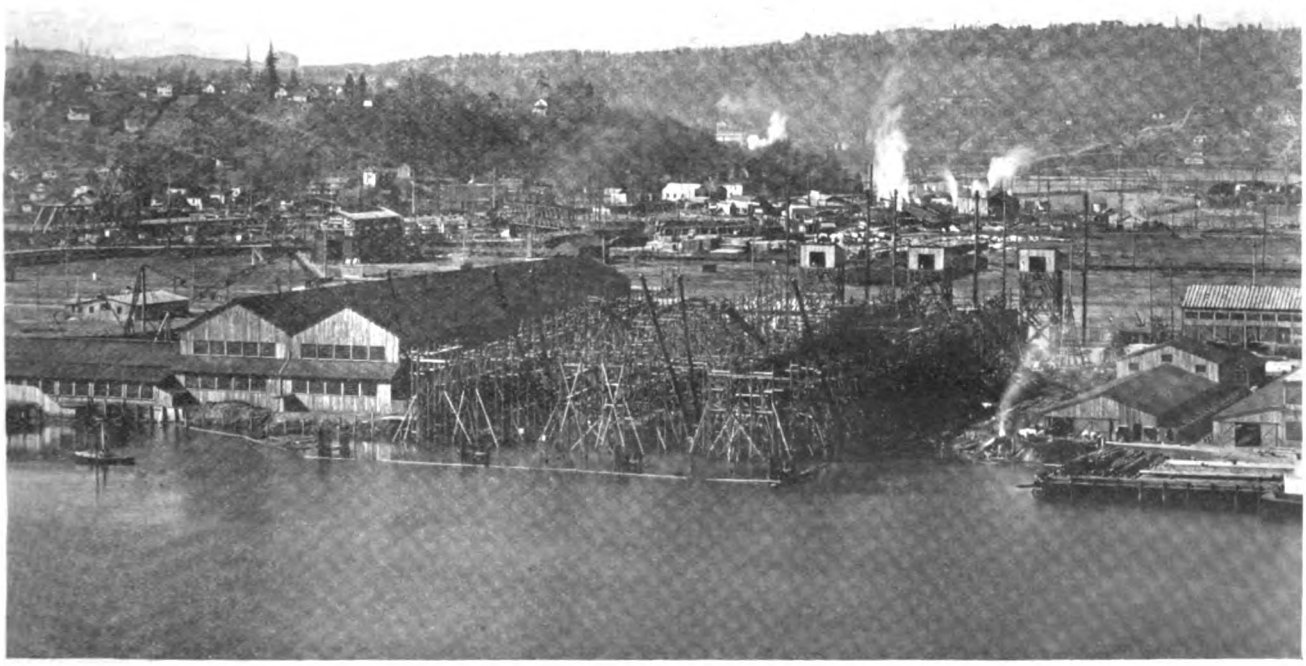
needed room for expansion, as the 9 acres added not only include room for more slips but will provide space for new machine shops, foundry, etc. All of the ships built by the Skinner Eddy Company have been powered with turbines bought from the General Electric Company, but with the new shops the company will start building 2,500-horsepower, triple-expansion engines.

Launch of the S. V. Harkness

On March 22 the Skinner & Eddy Corporation, of Seattle, Wash., launched the first of two bulk oil tank vessels building for the Standard Oil Company of New Jersey. She was the *S. V. Harkness,* with port of registry at Bayonne, N. J., and will be delivered to the owners the latter part of April.

The general dimensions of the ship are: Overall length, 435 feet 6 inches; beam, 57 feet; depth, 31 feet 6 inches; load draft, 24 feet; speed, 10½ knots; deadweight, 9,000 tons. She is a single screw ship, of poop, bridge and forecastle type, with a partial second deck and machinery located aft, and is being built on the Isherwood system to Lloyds Class 100 A1, and is the largest commercial vessel so far built in the Northwest, exceeding in length by 11 feet 9 inches the *Neils Neilson,* also built by the Skinner & Eddy Corporation.

She will be equipped with three Scotch marine boilers, 14 feet 9 inches inside diameter by 11 feet long, having about 2,700 square feet of heating surface when burning oil with a working pressure of 190 pounds. They were built by the Commercial Boiler Works, also of Seattle. These will furnish steam to the Curtis type turbine of the General Electric Company's manufacture, developing 2,500 shaft horsepower at 100 revolutions per minute, geared to the shaft driving a four-blade propeller of 16 feet 9 inches diameter. There will be five stages in the ahead and two stages in the reverse turbine. Her sister ship is the *Josiah Macy,* and will be launched on April 21. Delivery of the latter ship will be made the latter part of May.



General View of the New Shipyard of the Duthie Shipbuilding Company, Seattle, Wash.

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Marine Terminal Improvements

The Export Railway Company, Tampa, Fla., is planning to spend $1,000,000 in building phosphate terminals at Tampa.

The Western Maryland Railroad Company, H. R. Pratt, Continental Trust building, Baltimore, Md., chief engineer, plans to build a pier at McComas street.

The Empire Limestone Company, 19 Hudson street, Buffalo, N. Y., has applied to the City Council of Buffalo for permission to build a dock.

The Western Fuel Company, 6 Grand avenue, Milwaukee, Wis., has let a contract to the Great Lakes Dredge & Dock Company, 491 Canal street, Milwaukee, to build an 800-foot dock.

A. B. Pouch, president of the American Dock Company, 17 State street, New York; J. B. Kilsheimer, president of the Staten Island Development Company, and others, are planning to build docks and warehouses on Staten Island. Applications have already been made for pier accommodations and a large frontage on Edgewater street has been secured. The general layout provides for several large covered piers of more than 1,000 feet in length, together with warehouses, wharves, etc. Many millions of dollars will be spent.

The Healey-Tibbits Construction Company, Main and Market streets, San Francisco, Cal., have received a contract from the State Board of Harbor Commissioners, California, to build pier 31, at a cost of $283,600.

Shipbuilding Aided by a New "Monroe Doctrine"

Shipbuilders of the United States are faced not only with the problem of replacing a vast amount of sunken tonnage but also with an opportunity and an excuse to build an American merchant marine, and, at the same time, to learn an economy and efficiency in ship production which will enable them to sustain and increase such a marine even amidst the war of competition in ship construction which is bound to follow the approaching peaceful settlement of the world's present conflict.

In building such a marine it is necessary to begin to figure on a reduction in the waste of material and an increase in the efficiency of labor. Cost systems must be established with mechanical devices to determine costs accurately and with despatch. Advantage must be taken of every opportunity to make one man do as much as two, three or four by putting more efficient machinery in his hands. Equipment must be placed in the hands of engineers which will relieve them of the boredom of making mental-pencil-and-paper computations and will leave their minds free for creative ideas.

By installing a Monroe Calculating-Adding Machine, for example, the figure work of a cost system can be turned out, it is claimed, two or three times as fast as by a pencil-and-paper method, and one Monroe machine at the cost of but 14 cents a day turns one or two office men loose to work at something else. Such a machine figures everything from a payroll to the total cost of building a ship, and so easily, it is claimed, that any office boy with a knowledge of figures can operate it. It is because of the Monroe's adaptability to marine figures that the United States Navy Yards at New York, Philadelphia, Portsmouth, Pensacola, Mare Island and Seattle, and The Chester Ship Building Company, The Union Iron Works, and The Bethlehem Steel Company have installed Monroe machines.

This one machine solves all of the most complicated formulæ, though they include even extraction of square and cube root, with which a marine engineer has to deal, for the Monroe not only adds but it subtracts, multiplies and divides just as easily as it adds. Every operation is direct; that is the numbers are set on the keyboard as on any standard adding machine, the crank is turned forward for addition or multiplication and backward for subtraction or division. There is no setting of levers and the operator is not hampered by the use of arbitrary rules. The machine is simple in construction. It is portable, weighs 26 pounds, and occupies less than a square foot of desk space.

In *addition*, the operator sets the numbers in the keyboard and gives the operating crank a turn forward. He has perfect visibility at every stage, and can check each amount as he proceeds before it is recorded on the numeral dials.

Subtraction is a direct operation and no complementary numbers are required. For example, it is desired to subtract $55,796.35 from $78,429.46. The operator sets the $78,429.46 on the keyboard, turns the crank forward, recording the number in the lower dial. He then sets the $55,796.35, turns the crank backward, and the answer, $22,633.11, appears in the lower dial at the right.

To *multiply*, the operation is as follows: It is desired to multiply 4,346 by 122. The operator sets up 4,346 on the keyboard and turns the crank forward two times. He then shifts the carriage one space to the right and makes two more turns. The carriage is then shifted another space to the right, the crank is turned forward once, and the result appears in the lower dial, 530212. The three successive steps taken register on the keyboard and dials as follows:

	First Step	Second Step	Third Step
Upper dial.....	2	22	122
Lower dial.....	8692	95612	530212
Keyboard	4346	4346	4346

It is desired to *divide* 4775.91 by 224. As multiplication is a process of continued addition, and is accomplished by turning the crank forward, so division is a process of continued subtractions, and is accomplished by turning the crank backward. The operator sets the dividend 4775.91 in the keyboard,

Monroe Calculating Machine

and by one turn of the crank forward registers it in the lower dial. He clears the upper dial and the keyboard, and sets the divisor, 224, in the keyboard. He then turns the crank backward, subtracting 224 from the first three figures of the dividend (477) as many times as it can be subtracted, which is two. The upper dial indicates the first figure of the result He then shifts the carriage one space to the left, again subtracts the 224 as many times as possible from the three figures of the dividend that appear immediately above it. He continues this shifting and subtracting until no further subtraction can be made.

The figures as they show up on the machine at the end of each step are as follows:

	First Step	Second Step	Third Step	Last Step
Upper dial...	20.00	21.00	21.30	21.32
Lower dial...	0295.91	071.91	04.71	0.23
Keyboard ...	224	224	224	224

The divisor, 224, remains constantly on the keyboard. At the last step the number appearing in red in the upper dial, 21.32, is the result (quotient); the number in the lower dial, 23, is the remainder. The whole operation requires but three or four seconds. If at any stage of the division too many turns of the crank are made, a row of 9's is brought up at the left of the dividend, instantly indicating the error. To correct this the operator merely turns the crank forward, bringing all the figures back just as they were before the error was made.

It is because of the Monroe's manifold versatility, combined with its direct simplicity, that the machine not only finds its function in doing the simpler calculations of the shipyards but in reducing such a formula as

$$I.\ H.\ P. = \frac{(3200)^{2/3} \times 12^3}{230} \text{ to } I.\ H.\ P. = 1{,}630$$

in about 60 seconds.

The Monroe calculating machine is manufactured by the Monroe Calculating Machine Company, Orange, N. J., and its general offices are in the Woolworth building, New York City.

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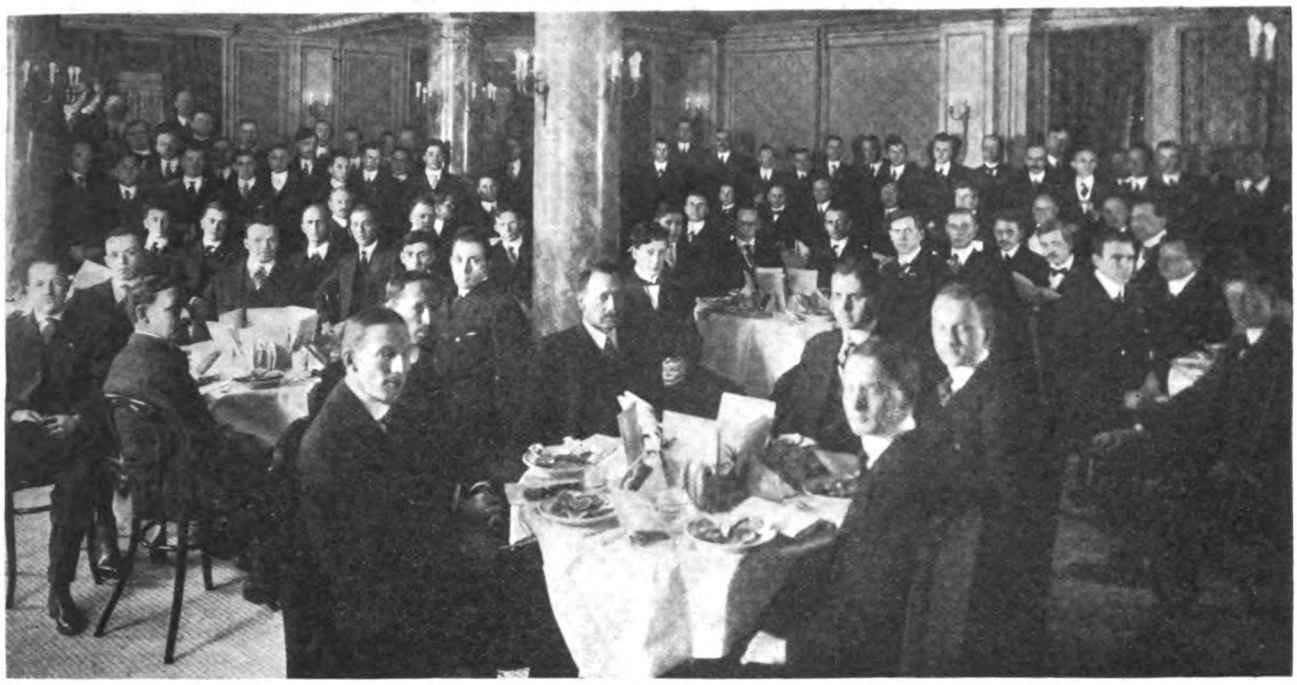

Joint Banquet of Branches Nos. 4, 3, and 15, American Society of Marine Draftsmen, Hotel Brewster, Boston, Mass., March 24.

Joint Banquet of the Boston (Navy Yard), Quincy and Fore River Government Branches of the American Society of Marine Draftsmen

Twenty-seven members of Boston (Navy Yard) Branch No. 3, forty-nine members of Quincy Branch No. 4, and twelve members of Fore River Government Branch No. 15—eighty-eight in all—attended a joint banquet at the Hotel Brewster, Boston, Mass., on Saturday evening, March 24. Mr. B. G. Barnes, the national secretary of the society and a member of the Quincy branch, of which he has also acted as secretary and president in the past, presided as toastmaster.

Professional entertainers filled in the time between courses with banjo, singing and dancing to the merriment of all, including Messrs. Bradford and Young (W. J. J.). Solos were rendered by Mr. F. J. Townsend, with Mr. Booth at the piano. Mr. F. Yeh, who although not a member of the society is employed as a draftsman and associated with the members of Quincy branch, entertained for about half an hour with well-performed conjuring and sleight-of-hand.

All present thoroughly enjoyed the evening, and the spirit of equity and good fellowship was truly exemplified, as evidenced by the co-operation which existed between Messrs. Wentworth and Prochazka. The thanks of the members were extended to the committee in charge of the banquet for their hard work and untiring efforts, and the programme committee were the recipients of much well-merited praise.

PERSONAL

JOHN EADIE has been appointed general manager of the Wallace Shipyards, North Vancouver, B. C.

J. J. EASON, formerly assistant superintendent of the Mechanical Division of the Panama Canal, has been appointed assistant shop superintendent at the Navy Yard, Norfolk, Va.

L. S. SHAW is now handling the interests of the Terry Steam Turbine Company in Detroit, Mich., and Victor L. Sanderson is connected with the Philadelphia office of the company.

ELLIOT N. BURWELL, naval architect, Boston, Mass., announces that he has moved his offices from the Paddock building, 101 Tremont street, to new and larger offices at 156 State street.

E. T. KLIPPERT, vice-president of the Eckliff Circulator Company, Detroit, Mich., is making a business tour of the Pacific Coast. While on the Coast, Mr. Klippert will inspect installations of Eckliff circulators recently completed there, including several in the large tankers now building for the Standard Oil Company of New Jersey.

W. I. BABCOCK, engineer and naval architect, has moved his offices from 17 State street to the Equitable building, 120 Broadway, New York.

WILLIAM W. SIME, Milwaukee, has been appointed manager of the trip-hammer department of the Keller Pneumatic Tool Company, Fond du Lac, Wis., and assumed his new duties April 20.

JOSEPH A. SLOAN, who was manager of the Washington Shipping Corporation's yard on Harbor Island, Seattle, Wash., has opened an office in Seattle as consulting naval architect. Mr. Sloan is still retained by the Washington Shipping Corporation, and is actively interested in several other wood shipbuilding plants.

W. H. ALISON, for thirty-five years connected with the Pacific Coast Steamship Company and its successor, the Pacific Steamship Company, Seattle, Wash., has resigned his position as superintending engineer. He obtained his early training with the Wm. Cramp & Sons Ship & Engine Building Company, Philadelphia, and the Risdon Iron & Locomotive Works, San Francisco. He will be succeeded by John D. Gilmore, chief engineer of the Union Iron Works, San Francisco.

GEORGE E. LAWRENCE, Philadelphia representative of the Eckliff Circulator Company, of Detroit, Mich., has been commissioned a first lieutenant in the U. S. N. R. F., and is now in active service somewhere along the Atlantic. Robert Bellows, of Fleeton, Va., another Eastern agent of the Eckliff Company, is also serving in the U. S. N. R. F., with a commission of warrant machinist. Both of these men are well qualified for the important duties to which they have been assigned, and will prove valuable aids to Uncle Sam.

OBITUARY

LOUIS WILLIAMS, Superior, Wis., for twenty-five years general superintendent of the Superior Shipbuilding Company, died March 22, aged 53 years.

GEORGE E. WEED, engineer and shipbuilder, died at his home in New York, April 7, aged 78 years. For the greater part of his active business life he was identified with the Morgan Iron Works, of which the late John Roach was chief owner. After the death of Mr. Roach he became president of the company and the connected Delaware Iron Shipbuilding & Engine Works at Chester, Pa. Mr. Weed was a charter member and vice-president of the Society of Naval Architects and Marine Engineers, and had been treasurer of the Engineers' Club of New York for the past seventeen years.

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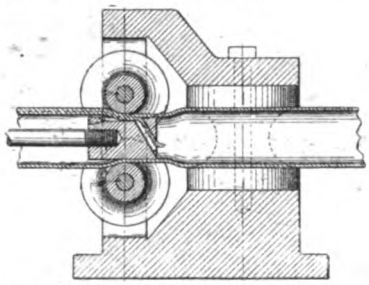
SELECTED MARINE PATENTS

The publication in this column of a recent specification does not necessarily imply editorial commendation.

American patents, compiled by Delbert [illegible], Esq., registered patent attorney, Millerton, N. Y.

1,215,773. METHOD OF AND APPARATUS FOR REMOVING INTERIOR BURS FROM TUBES. HARRY [illegible] R, OF CLEVELAND, OHIO, ASSIGNOR TO THE [illegible] LDING COMPANY, OF CLEVELAND, OHIO, A COR[illegible] OHIO.

Claim 1.—The method of removing a bur, [illegible] the interior of pipe or tubing, which consists in pas[illegible] tubing over a suitable member within the same provi[illegible] ig edge



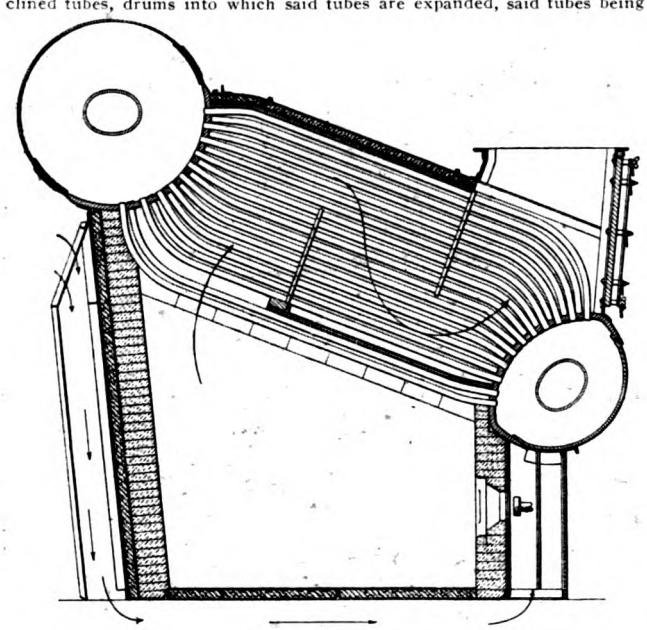
normally out of operative contact with the interior; and simultaneously deflecting the portion of the wall of such pipe or tubing to be operated upon into engagement with such cutting edge. Eight claims.

1,192,546. SUBMARINE PROPULSION. DANIEL FRANCIS MURPHY, OF PRINCE RUPERT, BRITISH COLUMBIA, CANADA.

Claim 1.—In combination with the hull of a submarine vessel, a propeller located adjacent the bow of the hull; means for rotating said propeller; means for adjusting the position of said propeller about an axis extending longitudinally of the hull; two outwardly opening recesses formed one in each side of the hull; a fin adapted to be moved into and out of each of said recesses; and means for moving said fins into and out of said recesses. Ten claims.

1,215,806. WATERTUBE BOILER. WILLIAM D. HOXIE, OF BROOKLYN, N. Y., ASSIGNOR TO THE BABCOCK & WILCOX COMPANY, OF BAYONNE, N. J., A CORPORATION OF NEW JERSEY.

Claim 1.—A steam boiler of the class described having a bank of inclined tubes, drums into which said tubes are expanded, said tubes being



curved at both ends and straight for the rest of their length and entering the drums radially, and downcomers at the side of the bank and expanded into said drums. Seven claims.

1,191,794. BOAT DAVIT. ROBERT JONES, OF FLORENCE, ORE.

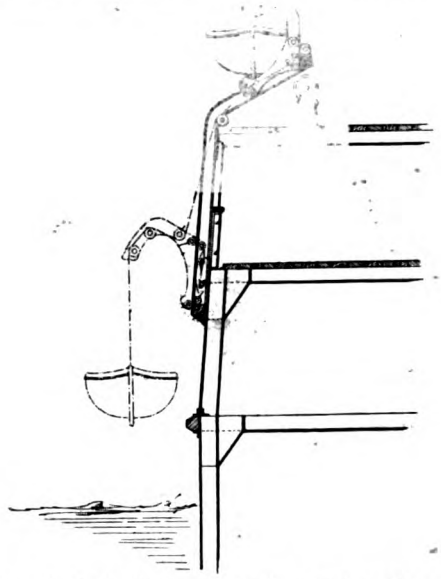
Claim 1.—The combination with a ship, of davits, pivotal and sliding connections between the lower ends of said davits and the side of the ship, head blocks carried by the upper ends of said davits, respectively, sheave wheels in each head block, hangers suspended from said head blocks, a life boat supported by said hangers, cables reeved through said head blocks over the sheaves therein and having the outer ends thereof connected with said hangers, drums connected to the inner ends of said cables, and means for rotating said drums to pull said cables to elevate said life boat and draw said davits inwardly, and means for sliding the davits upwardly in the swinging movement thereof so that the life boat may clear the deck of the ship. Three claims.

1,187,522. SUBMARINE BO[illegible] GRIESHABER, OF NEW LONDON, CONN., ASSI[illegible] ECTRIC BOAT COMPANY, OF NEW YORK, N. [illegible] RPORATION OF NEW JERSEY.

Claim 1.—In a submarine boat, [illegible] of a hull, a ventilator leading to the interior thereof, [illegible] the outer end of the ventilator having an opening th[illegible] alve-member and means for moving the valve-member to [illegible] through the ventilator or to open that passage and clo[illegible] through the inclosure, said inclosure having a second [illegible] rough which is distant from the outer end of the ventila[illegible].

1,191,410. MEANS FOR [illegible] A SHIP'S BOATS. DANIEL E. ERICKSON, OF V[illegible] RITISH COLUMBIA, CANADA.

Claim 1.—Means for lowering [illegible] the deck of a ship, said means comprising the combinatio[illegible] ecured to the ship ad-

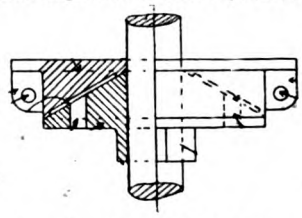


jacent each end of the boat, said track extending from an inboard position on the deck to and down the side of the ship to a position intermediate the deck and the water line, a boat suspending davit connected to and endwise movable on each track, and means for lowering the davits down the track and the boat from the davits. Five claims.

British patents compiled by G. F. Redfern & Co., chartered patent agents and engineers, 15 South street, Finsbury, E. C., and 10 Gray's Inn place, W. C., London.

100,412/16. RUDDERS OF SHIPS. C. W. A. TAYLOR, OF KYRSTYVILLE, HOLMSIDE AVENUE, DUNSTON-ON-TYNE.

This invention relates to that class of fitting as applied to the deck of ships where the rudder stock passes through same; it has for its object to improve their construction and make them more efficient and is applicable to one or more decks in cases, where the rudder stock passes through more than one deck. To the deck of the ship where the stock of the rudder passes tnrough same is fitted a plate (called the deck plate),



either in halves or otnerwise, having a hole in the center slightly larger in diameter than the diameter of the rudder stock, and the upper surface of this plate is formed conical either convex or concave. To the rudder stock is fitted another plate (called the stock-plate) either in halves or in one piece, the lower face of this plate being conical in the reverse way to the deck plate, but at the same bevel or taper so that the conical face of the stock plate will bear on and work freely in contact with the conical face of the deck plate. In the concave face of the deck plate are formed two or more cavities and in the convex face of the stock plate are formed cavities; all these cavities are filled with grease or its equivalent before fitting in place, and through the stock plate or deck plate or both means are provided of charging the cavities with grease or the like; one convenient way is by forming holes leading from the top of the stock plate into the cavities.

101,733/16. "IMPROVEMENTS RELATING TO SHIPS' RUDDERS." C. A. JACKSON, OF 12, HAVELOCK TERRACE, SUNDERLAND, IN THE COUNTY OF DURHAM, ENGINEER.

This invention relates to ships' rudders, and has for its object to provide improved means for attaching the rudder stock to the stern frame of a ship. According to this invention, the stern frame is provided with a number of lugs or gudgeons forming part bearings, the complementary parts of said bearings being formed in caps adapted to be secured to the lugs or gudgeons, the bearings being adapted to receive and embrace the rudder stock. Strips or linings of anti-friction metal or material may be provided within the bearings, and steel or like bushes may be provided on the rudder stock to form bearing surfaces.

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